THE TELEGRAPHIC JOURNAL AND

Electrical Review.

VOL. X.—NO. 233.

THE PROGRESS OF ELECTRIC LIGHTING.

No one can have failed to observe the great increase in the number of electric lighting companies during the last few weeks, and one almost expects now in taking up his daily paper to see each morning the advent of some fresh system, each one in its advertisements trying to outvie its predecessor by the glowing terms in which its merits are set before the public. Whatever may be the ultimate success of these companies, the very fact of their ever-increasing numbers is sufficient to show that the general public is taking a very decided interest in the great problem of electric lighting. The recent development of these companies may, to some extent, be explained by the advertisement of the Commissioners of Sewers requesting tenders for illuminating various fresh sections of our City. This action on the part of the City authorities leads us to believe that they are in favour of having the principal thoroughfares lighted electrically, and, doubtless, such is the general feeling if the question of cost can be satisfactorily settled. If each of the six districts to be illuminated has a different system (which we hope will be the case), then the cost of each will certainly be more than what is now paid for gas. But if at the end of the experimental trials the Commissioners should think fit to adopt the system they consider best for the whole installation, then the electric light will have a fair chance of proving its superiority over gas, even when the question of economy is the main point at issue. Up to the present the area illuminated by any system of electric lighting has been very limited, and therefore we are very much in the dark as to its real value as an illuminant, economically speaking; but, like many other things, when the demand for it increases its cost will be lessened.

The display of the numerous methods of lighting by electricity at the Crystal Palace, and the visits of deputations from various public bodies to that centre of attraction, has also contributed in no small degree to the activity now observable in this comparatively new commercial enterprise. It is very pleasing to electricians, and others who believe in the brilliant future of the electric light, to watch its development month by month—we might almost say now, day by day—and to note the amount of capital constantly being invested in the electric light companies, which must be very considerable. It cannot, however, be expected that all these new concerns which are so constantly cropping up are likely to be equally successful, nor is it probable that certain systems which have hitherto carried all before them can look for a continuance of such good fortune; and it is therefore very desirable that those wishing to obtain shares in electric light companies should carefully calculate the chances of the future before investing heavily in any particular one. The public, however, is not prone to look upon such matters from a scientific point of view, and if a report emanating from some authority states that a certain lamp gives a light intensity of 2,000 or 4,000 candles, as the case may be, it is looked upon as a first-class investment, the question of power consumed in the production of such a result apparently not entering into the calculation at all. Not only is this strange mode of comparing lamps common to the general public, but it is also a frequent question of those interested in the formation of companies, "What is the candle-power of such and such a lamp?" the idea that the candle-power may be made either great or comparatively small by the employment of more or less power never entering their heads.

Most of the various arc lamps at present in existence may be made to yield the same amount of light for the same consumption of power, and by burning the same carbons. The superiority of certain arc lamps over others is due more to the simplicity of their working parts, the length of time they act unimpaired, and to their not requiring any attention beyond that which is absolutely necessary for recharging. If any particular incandescent lamp has an advantage over others in the market it may be put down to almost the same reasons—cheapness and lasting properties. With dynamo-electric machines we are somewhat limited for choice. Perhaps the nearest approach to perfection is the Gramme machine, although that of Messrs. Siemens is almost, if not quite, as efficient. These two probably give better results than any other machine now in use for power consumed in driving them. The investing public should be aware that a company having a bad lamp of one inventor and a good machine of another, and *vice versa*, cannot be such a promising investment as that of a complete system of machine and lamps, both arc and incandescent, which are all fairly good, even if not the best of their class. There is, however, another matter in connection with dynamo-electric machines which the promoters of further new companies might well seriously consider, and that is the question of expense. They are now inordinately dear (they are not so very expensive to construct), and if any company brought forward a machine of moderate efficiency constructed for use with six or twelve arc lamps and at a cost considerably below that now enforced, we feel quite convinced that a large business would be the result. The apparatus connected with electric lighting has not yet had sufficient time to assume the compact form shown by gas works, but even now its progress is on the whole very satisfactory, and we may safely look forward to the erection of some large central station during the next year or so for producing and supplying the electric light to a whole district. The installation of Mr. Edison's system of lighting by incandescence on the Holborn Viaduct shows perfectly well the practicability of such an undertaking. Never before has so much interest been manifested in the lighting of our streets, factories, shops, and houses, and never before have such financial opportunities been offered to those companies who are in possession of reliable systems of electric lighting.

In concluding this article we would refer our readers to other columns of this week's issue of our journal in which we have dealt still further with this subject and in a different manner. We may also here observe that no less than five new companies for electric lighting have been registered since we went to press last week.

THE BAUDOT TELEGRAPH.

(*Third Article.*) 354

WE are now going to enter upon the detailed description of the parts which constitute the complete apparatus of transmission, then we shall indicate the grouping of these different parts so as to constitute a telegraph office.

Manipulator.—The manipulator represented in fig. 4 is formed of a key-board with five keys, divided into two groups by a fixed black key. Each key is supported by a lever which works a tongue oscillating between two stops connected, the one with the positive pole, and the other with the negative pole of two batteries, the other pole of each being connected with the earth plate. Each tongue is connected with a corresponding division in the distributor, communicating with the line. The effect of pressing down the key is to bring the tongue in contact with the working stop and to produce a positive emission on the line. We know that on the contrary the position of rest of the key corresponds

FIG. 4.

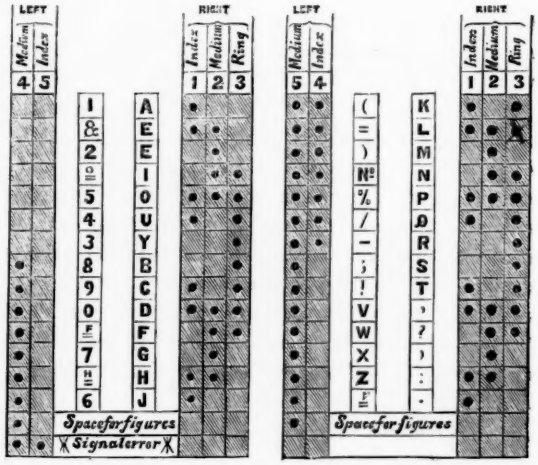
to a negative emission directed on the same division of the distributor. If we now refer to the annexed table we shall see the correspondence between the emissions and the signals.

			1	2	3	4	5
1st	combination	...	—	—	—	—	—
2nd	,, ...	A 1	+	—	—	—	—
3rd	,, ...	B 8	—	—	+	+	—
4th	,, ...	C 9	+	—	+	+	—
5th	,, ...	D 0	+	+	+	+	—
6th	,, ...	E 2	—	+	—	—	—
7th	,, ...	É &	+	+	—	—	—
8th	,, ...	F F	—	+	+	+	—
9th	,, ...	G 7	—	+	—	+	—
10th	,, ...	H H	+	+	—	+	—
11th	,, ...	I I	—	+	+	—	—
12th	,, ...	J 6	+	—	—	+	—
13th	,, ...	K (	+	—	—	+	+
14th	,, ...	L =	+	+	—	+	+
15th	,, ...	M)	—	+	—	+	+
16th	,, change from letters to figures		—	—	—	+	—
17th	,, ...	error	—	—	—	+	+
18th	,, ...	N No.	—	+	—	+	+
19th	,, ...	O 5	+	+	+	—	—
20th	,, ...	P %	+	+	+	+	+
21st	,, ...	Q /	+	—	+	+	+
22nd	,, ...	R —	—	—	+	+	+
23rd	,, ...	S ;	—	—	+	—	+
24th	,, ...	T !	+	—	+	—	+
25th	,, ...	U 4	+	—	+	—	—
26th	,, ...	V '	+	+	+	—	+
27th	,, ...	W ?	—	+	+	—	+
28th	,, ...	X ,	—	+	+	—	—
29th	,, ...	Y 3	+	+	—	—	—
30th	,, ...	Z :	+	+	—	—	+
31st	,, ...	T .	+	—	—	—	—
32nd	,, change from figures to letters		—	—	—	—	+

The 32 combinations formed with 5 positive or negative emissions, are utilised for producing at will letters, figures, or conventional signs. The first combination (5 negative emissions) corresponding to the position of rest of the 5 keys is the only one not utilised. It must be remarked that one combination serves to represent two signs. For this purpose M. Baudot has applied an arrangement to be found in an earlier telegraphic apparatus, that of Professor Hughes. We shall have occasion to speak more fully of this arrangement when we describe the receiver. To give a rough idea of it for the present, let us imagine that the characters of one series (letters) alternate on the type-wheel with the characters of the other series (figures or conventional signs), being spaced regularly. In the normal process of printing the succession of the types presented to the paper always brings after one character another of the same series. In order to pass to the other series the wheel must undergo an angular displacement equal to the interval on the circumference which separates two consecutive types belonging, as we have said, to two different series. A special combination of emission (— — — + —) serves to pass from the series of letters to that of figures; another combination (— — — — +) produces the opposite effect.

As regards the working of the keys, it has been regulated so as to cause the least fatigue to the operators; three keys are worked with the right hand (first, second, and third fingers), and the two others with the left (first and second fingers).

The annexed table of manipulation shows the correspondence between the signals to be produced and the fingering of the key-board.



In reality the manipulator is less simple than the description we have just given. The lever supporting the key works several tongues, each moving between two stops, as the single piece we have described moved. These accessories serve to produce various complimentary effects. Generally there are four tongues connected with one key.

The first, as we have seen, is employed for the transmission properly so-called. The last serves for the emission of the current from a local battery which, by means of the distributor, works the receiver at the starting-point, and there effects what is technically termed the "collationnement" of the despatch, which is merely the reproduction, as a kind of check, on the band of the transmitting office of the message printed at the office to which it is sent by the working of the line.

Two other tongues, also in communication with the division of the distributor corresponding to the key, oscillate between two stops connected with special circuits, and produce a system of emissions suitable for overcoming the phenomena of charge which impede transmissions in long lines. We shall return to the action of these currents called compensation currents.

Fig. 4 shows the handle of a commutator serving to establish communications for transmission or reception. In order to prevent the operator from working the keys during the period of reception, a special arrangement actuated by this handle renders the first key fixed, and thus warns the

employé, who otherwise might be in danger of transmitting into space.

The manipulator also bears a sounding instrument, which gives the operator notice to be in readiness to begin the emissions in the period of the movement of the distributor which corresponds to the sector in which the manipulation is utilised. This sounding instrument is formed of an electro-magnet worked by a local battery, the circuit of which is established by the rubber of the distributor at the proper moment. This communication will be indicated more in detail in the description of the distributor.

(To be continued.)

THE GÜLCHER ELECTRIC LIGHT.

Prominent in the list of new companies promoted for the purpose of utilising the electric light is that for developing the system of Mr. Gülcher, the practical working of which has for some time past been successfully demonstrated at the engineering works of Messrs. Ransome & Co., King's Road, Chelsea. Mr. Gülcher has both machine and lamps included

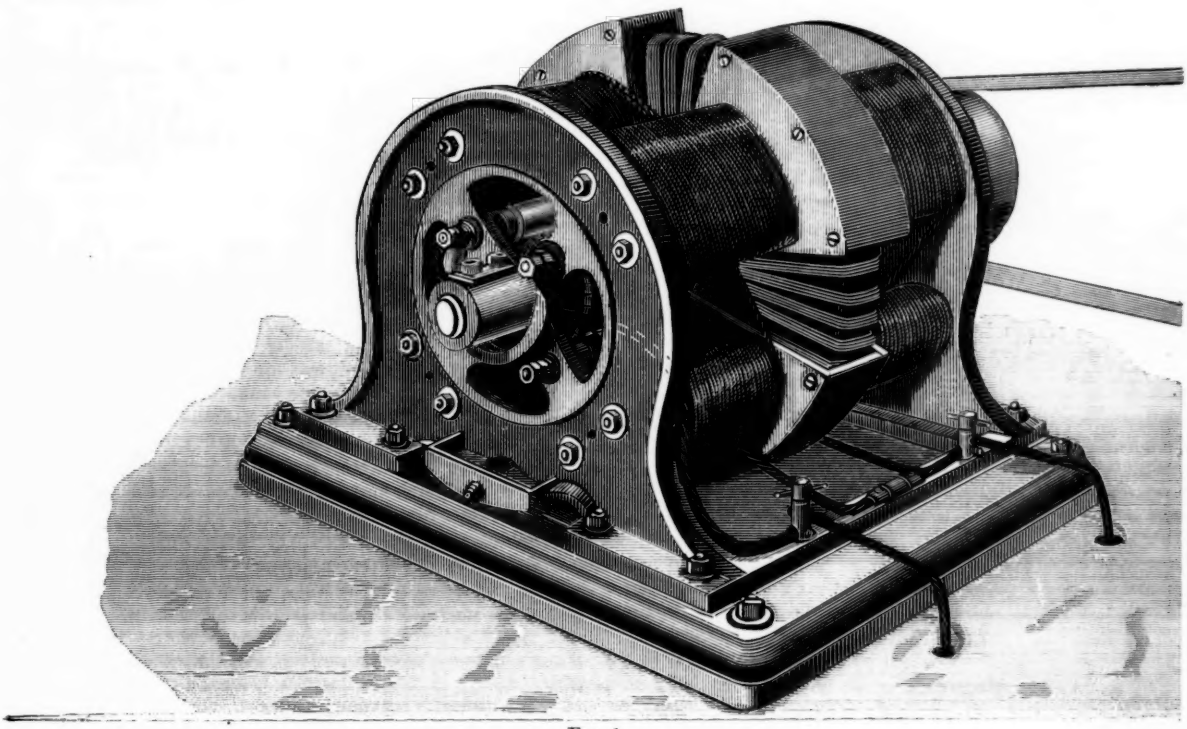


Fig. 1.

in his method of producing the electric light, but perhaps the most interesting part of his arrangement is the mode adopted for employing his lamps. This method, which differs from all other arc lamp systems, is simply the use of a parallel circuit instead of working the lamps in series as is usually the case. Although nothing new is contained in such connections, Mr. Gülcher may fairly be entitled to the credit of being the first inventor of a system wherein such a method of working has been practically successful, and this success is due to the simplicity and sensitiveness of his lamps. It has, however, other advantages, which we shall make apparent after a short description of the apparatus constituting the Gülcher application of the electric light. The machine (fig. 1) is of special construction, and its bobbin is based on the Paccinotti ring principle with fifty-two sections of wire. For the employment of a number of arc lamps in a parallel circuit it was of course necessary to arrange the machine to give an electromotive force sufficient for the proper working of a single lamp, but with an intensity of current sufficient to divide up amongst several —in the present instance, eight. For this purpose the resistance of the bobbin and of the electro-magnets (of which there are four on each side) had to be reduced to a minimum, and how this was effected will be shown further on. The electro-magnets are of a flat form and wound with an insulated copper wire rope, as solid wires of large diameter could not well be coiled. The corresponding poles of each pair of electro-magnets placed opposite to each other are connected together by a trough or shoe forming three sides of a square, so that not only the sides of the revolving bobbin are under magnetic influence but also its periphery. The transverse section of the bobbin is wedge-shaped, in order to utilise to the utmost the coiled wire. The mechanical arrangements of the bobbin are such as to keep it very cool, as it forms in conjunction with the shoes of the electro-magnets a powerful ventilator. The commutator and its brushes forms another special feature in this machine, a much greater contact surface being provided than is to be seen in other systems. This is, however, more necessary than would be the case if high tension current machines were employed. The almost complete absence of sparking is a conspicuous feature in the construction of Gülcher's commutator. As the ring is encircled by four pairs of poles there are four sets of brushes connected with the commutator. The two positives are joined together, and the two negatives also, each combination thus forming one large brush one a positive and the other a negative. It will be seen, therefore, that the internal resistance of the bobbin measured between these brushes would be but $\frac{1}{16}$th of the whole ring. The arrangement of these brushes is shown at fig. 2, one diagram showing the ring A, pole pieces N, S, and brushes, +, —; and the smaller diagram showing how brushes are connected. The electro-magnets are also connected up in such a way (fig. 3) that all the ends nearest the pole pieces are joined together and carried to one brush +; and all the remaining ends to the terminal marked +, the other brush being connected to terminal —. This arrangement, therefore, reduces the total resistance of the electro-magnets to $\frac{1}{8}$th that of a single one. The section of the bobbin is at 1, and the poles encircling the bobbin at 2, the commutator 3, brushes 4, and electro-magnets E, connected as shown.

The lamps of Mr. Gülcher, it will be remembered, constituted one of the attractions at the Paris Electrical Exhibition last year, and we gave an illustrated description of them in our issue of November 15th last, to which we now refer our readers. We also in the same article described the manner in which Mr. Gülcher disposes his conductors

so that each of the divided circuits shall have the same resistance, and we now illustrate this method by figs. 4 and 5.

If we suppose two of the lamps (fig. 4) introduced in a parallel position between the poles of a source of electricity, it will be plain that the one lamp regulates the other. Let the first lamp be kindled by closing its circuit, then when the circuit of the second lamp is closed, the main current (which is rendered stronger by the double closing) is divided into two branches. The branch which flows through the second

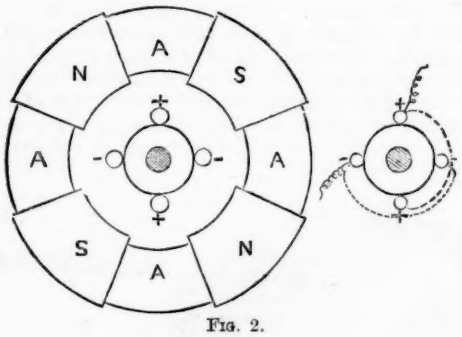


FIG. 2.

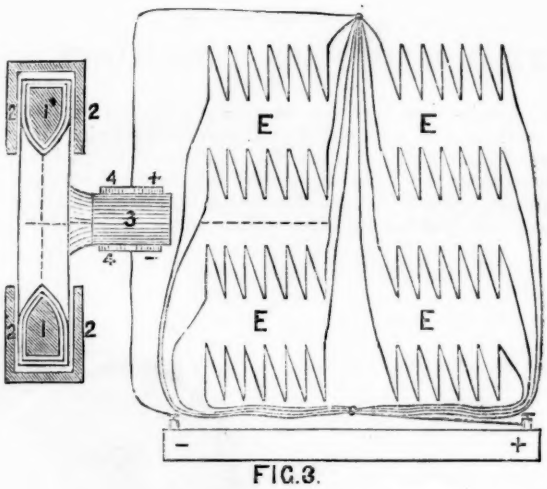


FIG. 3.

lamp is stronger than that of the first; because in the second the carbon points touch each other, and the resistance in this branch is less than in the other. As a consequence, the second lamp is brought into action by the energetic

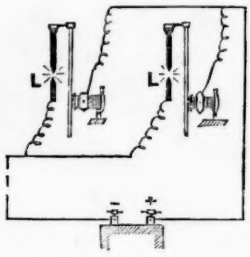


FIG. 4.

action of the electro-magnet, which withdraws the carbon points from each other; whilst in the first lamp, in consequence of the decrease of this branch of the current, the carbon points are approximated, and so the light is rendered stronger. Thus each lamp regulates the other, and consequently itself, so that in a very short time they are brought into complete equilibrium.

The arrangement for effecting an equal distribution of the current among the lamps (fig. 5) is as follows:—As soon as the number, n, of the lamps to be supplied from the machine is known, and the total length of the conductor, the diameter, D, of the conductor for the total current is calculated. Then a diameter, d, is calculated according to the formula,

$$\frac{\pi D}{4} = \frac{n \pi d^2}{4} \quad \text{or} \quad d = D \sqrt{\frac{1}{n}}$$

and a cord is formed of n wires of the diameter, d, the section of which taken together is equal to the section of a single wire of the diameter, D. This cord is connected with the one pole of the source of electricity (*e.g.*, the positive), and led to the first lamp, where one wire branches off, passes through the lamp, and is then led on parallel to the remaining n—1 wires; at the second lamp a second wire branches off from the cord, and after it has passed through, the lamp is united with the wire coming from the first lamp. Going on in this manner, the whole of the wires are at last united together again in a cord of n wires, which returns to the negative pole of the source of electricity. In this manner the resistance for each lamp is of the same value.

We believe, however, that since the Paris Exhibition Mr. Gülcher has considerably improved both lamps and machine. The form of lamp now adopted, and as used at Messrs. Ransome's works, is somewhat different in form to that described by us last year, but its mode of action is identically the same; therefore it is sufficient to refer to it merely. We give the following figures relative to the machine and lamps now in London, and for which we are indebted to Mr. Gülcher himself. With the machine running at from 810 to 830 revolutions per minute, and with 8 lamps in circuit, the potential difference at the terminals of the machine = 62·40 volts.

At the ends of the electro-magnets = 9·45 volts.
Between the brushes ... = 71·85 „

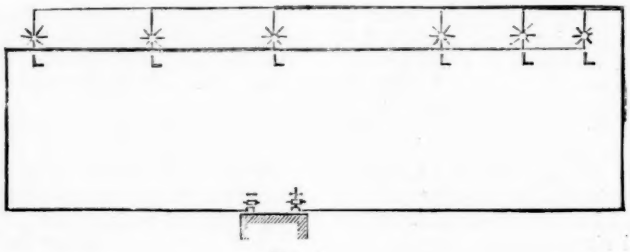


FIG. 5.

The resistance of machine bobbin and electro-magnets combined = 0·159 ohms. The total intensity of the current was 118 ampères, each lamp therefore receiving about 14·75 ampères. The intensity of the light, as measured horizontally from one of these lamps, gave 1,692 candles,

and at an angle of 34° the same lamp gave a light of 2,030 candle-power. The total horse-power absorbed in the external circuit of 8 lamps was 13·23, and the total amount of light produced at the angular position 16,240 candles. This gives a result of about 1,230 candles per horse-power. Mr. Gülcher calculates that the power absorbed in one lamp at the candle-power of 2,030, without calculating loss in conductors and machines, is 0·88 horse-power, or, that 2,300 candle-power is produced per horse-power used in the lamp.

The lamps and machine now exhibited at Messrs. Ransome's are, we believe, an improvement upon those which were first installed there, and which were described in the "Zeitschrift für Angewandte Elektricitätslehre," translated in THE ELECTRICAL REVIEW of March 4th, p. 159. The light per lamp was given, in the translation referred to, as between a maximum of 1,500 and a minimum of 1,200 candles, a variation of about 20 per cent., and averaging 1,350 candles, each lamp requiring an additional 1·5 horse-power, and giving, therefore, an equivalent effect of 813 candles per horse-power. Through the courtesy of Mr. Robert Sabine, who has taken a series of tests on the present Gülcher system, we are enabled to give still further particulars regarding its effectiveness.

Mr. Sabine informs us that his tests upon the recent installation clearly indicate a marked improvement in the performance of the new machine and lamps. Measured at about the same angle (34°) the candle-power per lamp is now between the maximum of 2,800 and minimum of 2,100, a variation of about 25 per cent., and averaging 2,300 candles per hour. The slightly greater variation is, of course, to be expected as a result of the higher power. But the greatest stride made by Mr. Gülcher appears to be in his new machine, which, according to Mr. Sabine's tests, indicates only about 2 horse-power per each additional lamp inserted, and giving between 2,800 and 2,100 candles. In other words, that the equivalent effect is now between 1,400 and 1,000 candles per additional horse-power, or an average improvement of nearly 50 per cent. This is, of course, due to the electricity at present employed being of higher electromotive force. Perhaps a somewhat higher equivalent effect still might be obtained by a higher speed, but we doubt whether Mr. Gülcher would be well advised in risking the whiteness and steadiness of his light for the doubtful advantage of a few candles'-light more per horse-power.

The whiteness of Mr. Gülcher's light is striking, and its steadiness is evidenced by the tests. A variation of 25 per cent. in an arc light is scarcely noticeable; the variations in the illuminating effect of most arc lamps, due to the irregular burning of the carbons, being seldom less than 50 per cent., and sometimes very much more.

In concluding our description of this somewhat remarkable system, we will call attention to the following advantages which it possesses. The lamps, on account of their simplicity, can be produced cheaply, and any number can be extinguished and rekindled without affecting the rest, or but very slightly so. The attention required by the lamps or machine is entirely unaccompanied by danger to life, and the system automatically regulates the horse-power required for any number of lamps. The insulation of the conducting wires need be but slight compared with cables used with high tension currents; but of course, as a set-off against this, the wires composing the conductor must necessarily be of larger diameter. There is, however, one point to be considered in connection with this method of lighting, or indeed of any other where the lamps are employed in a similar way, and that is the provision to be made for insuring freedom from the chance of the carbons running together, sticking fast, and thus forming approximately a short circuit in the system, whereby all the lamps would be rendered useless. We presume that this matter has been fully considered by the inventor, if we may judge from the other details of his apparatus. On the whole, the advantages of a good parallel circuit arrangement are considerable, and Mr. Gülcher's system is sure to meet with the success it certainly deserves; our own impression of the light, when visiting the works of Messrs. Ransome, being a most favourable one, and the results we have given show that it will compare on advantageous terms with others more widely known.

THE AMENDMENT OF THE LAW RELATING TO PATENTS FOR INVENTION.

By T. J. HANDFORD.

THE advent of the Bill to Amend the Law Relating to Patents (commonly called the Society of Arts Bill), recently introduced by Sir John Lubbock and read a second time by the House of Commons, affords a favourable opportunity for inquiring into the defects in the existing law and considering in what respects it requires amendment. In thus speaking it is assumed that some amendment is necessary, for upon this point the most complete unanimity prevails, although when we come to discuss the particular directions which the alterations in the law should take, there the agreement ends, each advocate for reform holding his own peculiar views as to the nature of the amendment which is required. For instance, inventors as a rule complain that the crying defects in the existing system are high fees and inadequate length of term, whilst manufacturers lament the large number of obstructive patents annually granted which impede the development of British industry; and the individual members of each of these two classes all differ from each other in the various shades of opinion which they hold on this important question.

It is obvious, however, that the ultimate object of any amendment of the law (not to say of the very existence of the law itself) is, or should be, the good of the public generally, and not merely the benefit of any particular class or section to the exclusion of the rest. While, therefore, the wants of inventors should receive a proper share of attention in any legislation upon the subject of the grant of patents, the public weal is the leading consideration which should guide our legislators in framing any measure of reform.

Looking at the matter, therefore, from an impartial point of view, we are bound to confess that the time has come when some effectual check should be provided against the grant of patents which are in themselves intrinsically worthless, but which nevertheless, from the advantage that even the semblance of a patent yields to its possessor, serve to create oppressive monopolies tending to hamper and impede industrial enterprise. It is, in fact, such abuses of the objects of the patent laws rather than the principle of the laws themselves which has excited the hostility of the opponents of patents and led to that agitation for the abolition of protection for invention with which so many prominent names stand identified.

For these dire results, however, it is unfair altogether to charge the patent laws, as patentees themselves, as well as their agents, are highly culpable in this matter. If applicants for patents have such seared consciences that, knowing the subject-matter of their applications to be old or unpatentable, in fact not *bonâ-fide* inventions, they can make solemn declarations to the effect that they believe they are in possession and are the first and true inventors of new inventions, and if patent agents from greed of gain will lend themselves to such nefarious practices, it is not logical to argue that the fault is in the patent laws themselves which are so grossly abused, although certainly the extent to which these practices prevail is a cogent argument for some stringent measures to prevent the recurrence of such frauds upon the rights of the public.

This brings us to the consideration of the provisions for examining all applications for patents, which form the most salient features in Sir John Lubbock's Bill.

It is proposed, then, that three paid Commissioners shall be appointed, viz., one experienced in engineering, another in chemistry, and the third in law, and these are to appoint examiners, to whom all applications are to be referred. The examiners are to report to the Commissioners whether the invention is subject-matter for a patent, and whether the title of the invention sufficiently indicates its nature, and whether the provisional specification is in accordance with the title. A copy of the report is to be furnished to the applicant, and if it be adverse to him he may appeal to the Commissioners. If the examiner reports against the

title and the provisional specification, or either of them, and his report is not appealed against, or is affirmed on appeal, the application will not be further proceeded with, unless the applicant within a prescribed time amends the title or provisional specification, as the case may be, to the satisfaction of the Commissioners. If the examiner reports that the invention is not subject-matter for a patent, the application may, notwithstanding that his report is affirmed on appeal, be proceeded with; but in that event every patent and every copy of the patent, if granted, and every office copy of the specification, will be indorsed with and bear on the face of it, a short statement of the examiner. If the examiner's report is favourable, it is to be presumed (although not distinctly so stated) that the applicant receives provisional protection forthwith, such protection, however, dating from the day of the application, and lasting (if the patent is proceeded with) nine months.

The final specification is to be filed at least three months before the expiration of the term of provisional protection, and application at the same time is to be made for the seal. The case is then again to be referred to an examiner, who will report to the Commissioners his opinion whether the complete specification is in accordance with the title and provisional specification, and whether the whole nature and object of the invention are described with sufficient clearness. A copy of the report is to be furnished to the applicant, and if it should be adverse he may appeal to the Commissioners against it; but if not appealed against or affirmed on appeal, the application may, nevertheless, be proceeded with, in which event, however, every patent and every copy of the patent if granted, and every office copy of the specification will be indorsed with and bear on the face of it a short statement of the report of the examiner. If desired, the applicant may file a complete specification in lieu of a provisional specification at the time of his application, in which case, of course, no further specification will be required.

As soon as the complete specification is settled, the Commissioners will publish it, and any person may then within a prescribed period enter opposition to the grant, on the ground of the applicant having obtained the invention from him, or from a person of whom he is the legal personal representative, but on no other ground.

Should there be no opposition, the patent will be sealed. In the event, however, of opposition, the Commissioners will hear the opposer, and decide the question much in the same way as such matters are now determined by the law officers, the Commissioners, at the request of either party, obtaining the assistance of an expert as an assessor. Two Commissioners are to form a quorum, and an examiner may be occasionally appointed to act as a Commissioner. The decisions of the Commissioners in all cases are to be binding and final. Provision is made for extending the term of provisional protection in exceptional circumstances.

Now the first thing that strikes one in reading the proposals which we have briefly epitomised is the absence of any *direct* examination as to the novelty of subject-matter of the applications. We say *direct* examination, for an answer to the question whether the contents of any application forms proper subject-matter for letters-patent does *indirectly* involve the consideration of novelty, since few things abstractedly considered are unpatentable, as it will generally be found on investigation that an alleged invention which is deemed to be not proper subject for a patent is only so from lack of novelty.

It is evident, however, that this comprehensive view is not that which is taken by the promoters of this measure, as they clearly wish to exclude from consideration the effect of prior publication or knowledge upon the novelty of the subject-matter. While, therefore, admitting that the investigation which the Bill proposes is a desideratum, we at the same time contend that it falls far short of what is needed to meet the exigencies of the case, for the inquiry must take a wider range and be of a more comprehensive character if ever the system of examination is to be of any real use to either inventors or the public.

In this respect the Bill introduced by Mr. Anderson more commends itself to our approval, and it is a matter for consideration whether the two Bills should not be fused into one, or a new Bill produced by extracting the best points of each.

We must further take exception to the proposed qualifications of the Commissioners to be appointed under the Act. It is not sufficient that one shall be experienced in engineering, another in chemistry, and a third in law, but both the engineer and the chemist must be well versed in patent law—that is to say, scientific and legal knowledge should meet and be concentrated in one and the same man, or else he is unqualified for determining the mixed questions of law and science which will constantly come before the Commissioners for solution.

Again, we fail to discover in the Bill any adequate appreciation of the magnitude of the task which the promoters have set before them. It is stated that "the Commissioners may from time to time, subject to the approval of the Treasury, appoint such persons qualified by knowledge of manufactures or science or arts as they see fit to be examiners of patents"; but to find the requisite number of persons suitable to act as examiners is precisely where the difficulty will arise, and no machinery is furnished by the Bill for giving effect to its provisions in this respect.

Exception has been taken to the proposal in the Bill to grant patents under protest, appending to them a permanent record of the adverse report of the Patent Office. It is evident however that, if, considering human fallibility, it is not thought desirable to invest the Patent Office with the power of absolutely refusing patents, the only alternative course open is to grant patents even when they are of doubtful validity, but at the same time make it clear upon the face of them that the Patent Office had raised objections against them, in order that both the public and the Courts may take cognisance of the fact. However, the opinion of those who take the opposite view, and who recommend that the Patent Office should be invested with full discretionary power to grant or withhold patents, is entitled to respectful consideration, as experience may prove that the liability to occasional error of judgment in refusing patents is fraught with less inconvenience than the grant of patents which to a moral certainty ought never to be allowed even although they bear upon them the record of the adverse report of the examiners.

(*To be continued.*)

ATTRACTION AND REPULSION DUE TO SONOROUS VIBRATIONS, AND A COMPARISON OF THE PHENOMENA WITH THOSE OF MAGNETISM.*

MR. STROH commenced his paper by alluding to the experiments of Bjerknes, which were exhibited at the late Electrical Exhibition in Paris. These experiments were hydro-dynamic; but the author thought that similar results would probably be obtained in an air medium, and preliminary trials proved this idea to be correct. The first experiment which Mr. Stroh exhibited was for the purpose of showing how the phenomenon of attraction could be produced. The apparatus for this purpose consisted of an ordinary harmonium reed, mounted on a small hand-bellows. The aperture over which the reed was fixed terminated in a short brass tube outside the bellows. This tube projects a short distance into a larger tube, an inch or two long, which has two branches, over which india-rubber pipes can be slipped. By working the bellows the reed is set in vibration, and corresponding pulses of air are sent along the rubber tubes. The instruments for receiving the vibration each consist of a tube, one end of which is slightly enlarged so as to form a kind of mouthpiece. Over the latter a rubber membrane is stretched; by attaching the further end of the tube to the rubber pipe from the bellows the membrane vibrates in consonance with the reed. If two of these tubes be attached respectively to the two rubber pipes, then the membranes at the end of each tube will vibrate in the same *phase*. One of these tubes in Mr. Stroh's experiments has the end to which the membrane is fixed bent at right

* Abstract of paper read before the Society of Telegraph Engineers and of Electricians, April 27th, 1882, by A. Stroh.

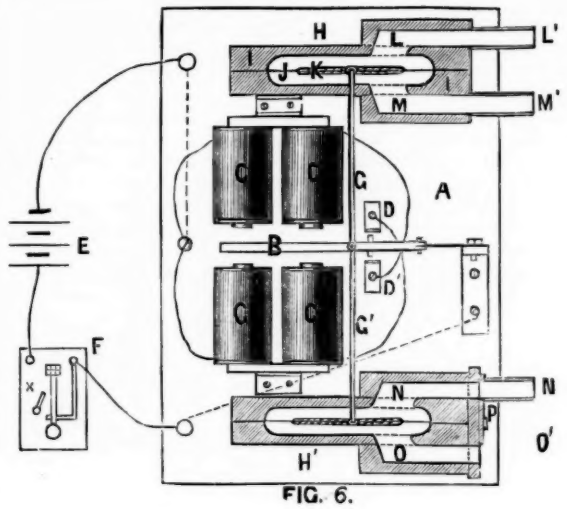
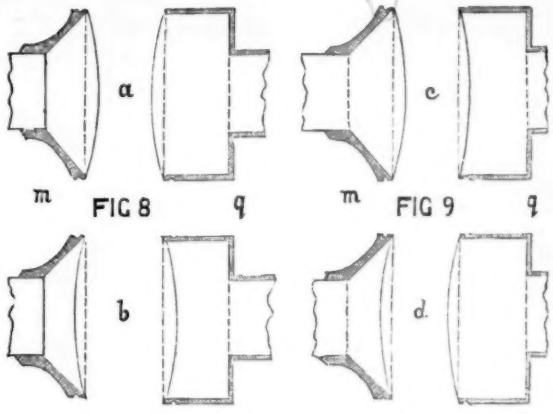


FIG. 6.



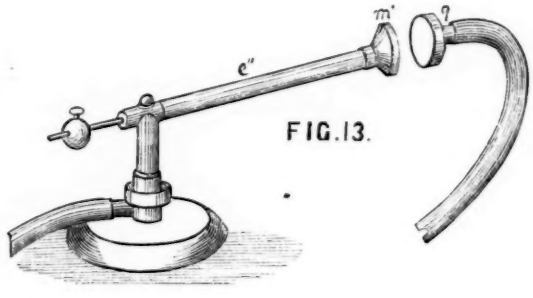


FIG. 13.

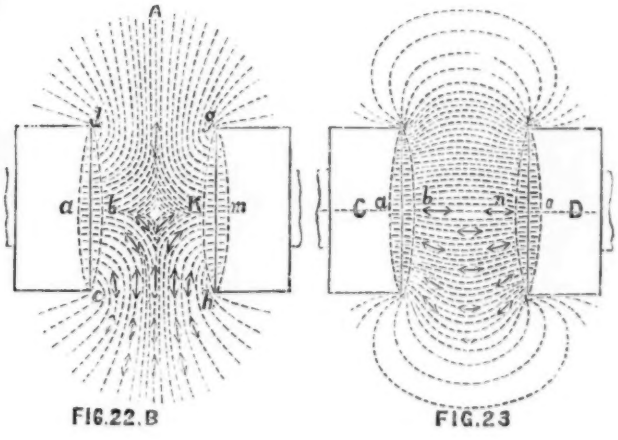


FIG.22.B FIG.23

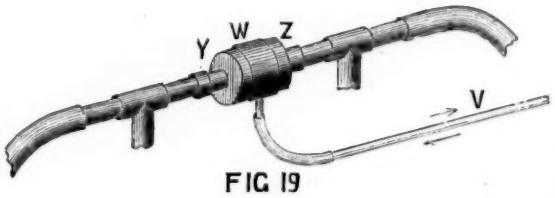


FIG 19

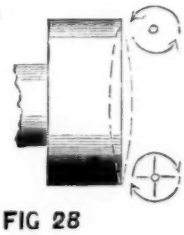


FIG 28

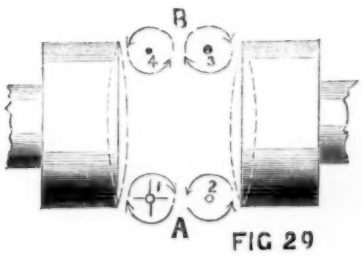


FIG 29

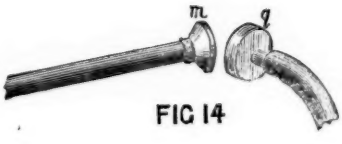


FIG 14

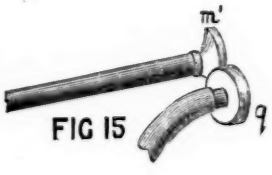


FIG 15

FIG.20

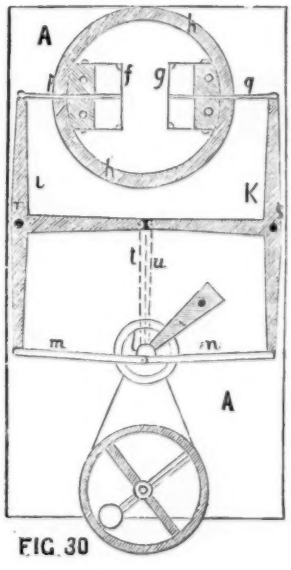


FIG. 30

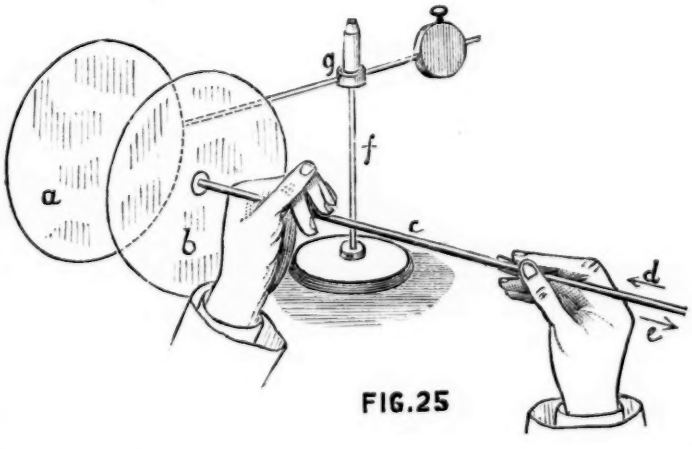


FIG.25

angles to the longer portion of the tube, and the whole is mounted on a stand in such a manner that it can turn round a vertical axis at right angles to the tube. If now the second tube be brought so that its membrane is parallel and opposite to the membrane of the movable tube, then the latter is strongly *attracted* when the two membranes are caused to vibrate by actuating the bellows. The freedom of motion of the movable tube is ingeniously obtained by means of a mercury joint.

In order to obtain the effect of *repulsion* which is found to take place when the two membranes vibrate in *opposite* phase, the apparatus shown by fig. 6 was designed. This

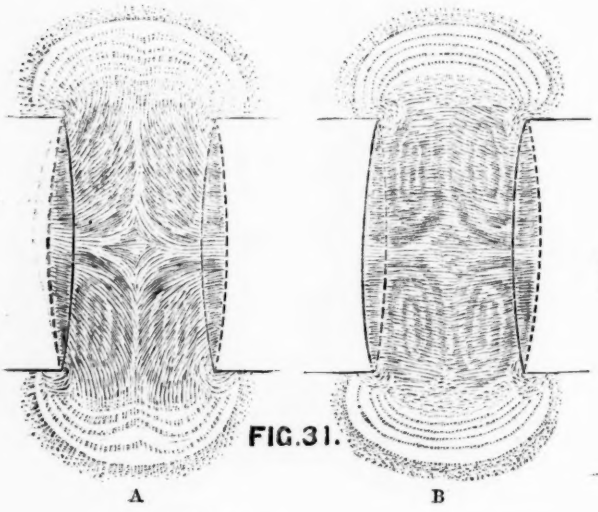


FIG. 31.

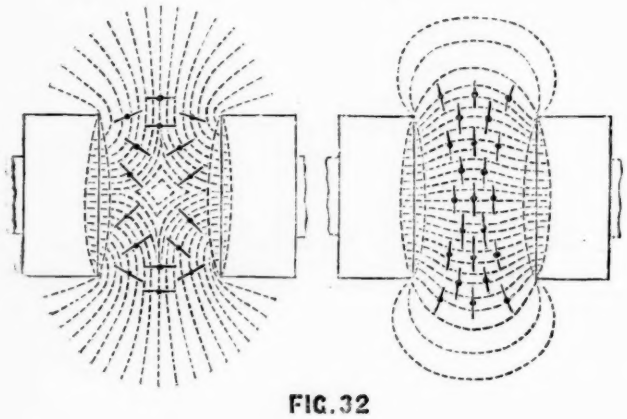


FIG. 32

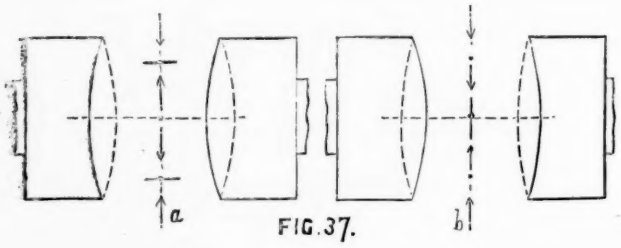


FIG. 37.

consists of a board, A, on which is mounted a vibrating iron armature, B, similiar to that employed in electric-house bells. The vibrations are maintained by electro-magnets, C C and C′ C′. D and D′ are contact springs, by which, when the armature, B, is vibrating, two separate electric circuits are alternately closed, each consisting of one of the two electro-magnets, and a battery of three or four cells, E, so that when the armature B makes contact with the spring D, it is attracted by the magnet C′, and when making contact with the spring D′, is attracted by the magnet C. The vibrating armature is connected to two leather diaphragms, contained in two wooden boxes as shown. Two nozzles, L′ and M′, communicate with the chambers on either side of the diaphragm J. One nozzle only, N′, is employed in connection with the second diaphragm, but this nozzle can be shifted by means of a lever, so that it can be put in communication with either of the cavities on either side of the diaphragm. Now, by connecting one to the rubber pipes from the membranous tubes, to a fixed nozzle, and the other pipe to the movable nozzle, then by shifting the latter from one side to the other, it is evident that the membranes can be caused to vibrate either in similar or dissimilar phase; in the former case (fig. 8) *attraction*, and in the latter (fig. 9) *repulsion* is produced. The effects, it will be seen, are the reverse to those of magnetism, where similar poles repel and dissimilar attract. A piece of card, or even the hand brought near the

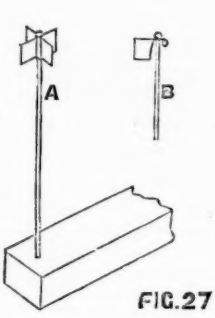


FIG. 27.

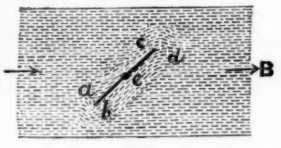
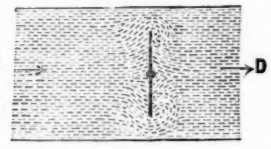


FIG. 33.



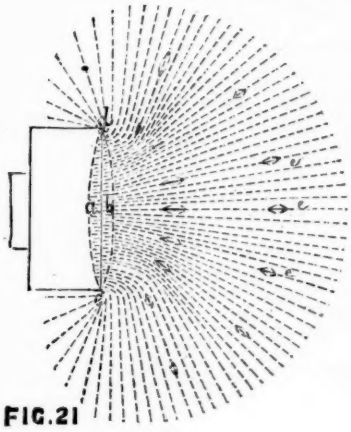


FIG. 21.

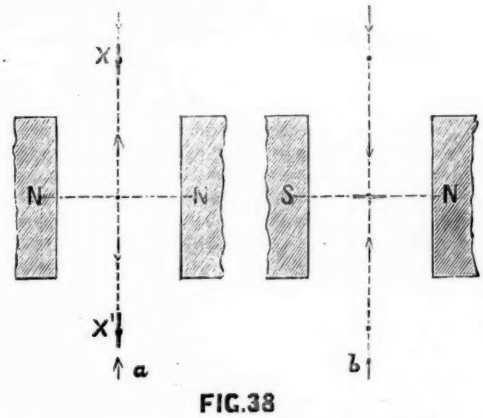


FIG. 38.

movable vibrating membrane, will cause the latter to be attracted just as a magnet attracts a piece of soft iron.

If the movable tube with the bent end be replaced by a straight tube, as in fig. 13, then if the drum *q* be presented to the drum *m*, the latter will place itself exactly opposite to it as in fig. 13—that is, when the membranes vibrate in similar phase, but repulsion will take place when the phases are dissimilar. Attraction and repulsion will even take place when the drums are in the positions shown by figs. 14 and 15.

If two vibrating drums are fixed opposite each other, and a small pith ball suspended at the end of a movable lever be set near them, then when the drums vibrate in opposite phase, the ball becomes attracted between them to the

central point between the drums; but in the case of opposite phase the ball is repelled from the central position, and moves to a point intermediate between the drums, but lying towards their circumference. Dr. Bjerknes has pointed out that a small pellet of soft iron will place itself between the poles of two electro-magnets in a precisely similar manner.

Most of the foregoing experiments are similar to those shown by Dr. Bjerknes in water, but the author has extended his researches and obtained certain results which might have escaped notice by the hydro-dynamic method. If two vibrating membranes be set close together, and be surrounded by a short piece of brass tube, W, fitting air-tight, and this tube communicates by a nozzle and a small piece of rubber tube with a length of capillary glass tube, V (fig. 19), in which there is a small column of coloured spirits of wine, then it is found that when the membranes vibrate in *similar* phase the liquid in the tube rises slightly, thus indicating a pressure; but when the phases are dissimilar, then the liquid sinks slightly, indicating a vacuum.

In order to determine the exact movements of the air that take place near the vibrating membrane, a little gas jet (fig. 20), A, was used, which was brought near the drum. Fig. 21 shows the effect created by a single membrane; fig. 22 by two membranes vibrating in similar phase; fig. 23 the effect given by vibrations in unlike phase. Mr. Stroh explained the probable action which caused the particular effects. A striking experiment to confirm his theory is shown by fig. 25; *a* and *b* are two cardboard discs, the disc *a* being fixed on an arm, *g*, which can turn freely on a steel upright pin, *f*, and the disc *b* is fixed to a wooden rod which rests loosely on the left-hand of the operator, while with the right hand it may be moved to or fro in the direction of the arrows, *d* or *e*. If the two discs be now placed parallel to each other, and about four or five centimetres apart, then if by a sudden movement of the right hand (in the direction of the arrow *d*), the disc *b* is pushed towards the disc *a*, but without allowing them to come into contact, the latter will not be repelled; a backward movement, however, produces a strong apparent attraction of the movable disc. An analysis of the motion of the air in the case of the membranes may be made by little windmills (fig. 27). If any of these be placed in front of a single vibrating membrane as shown in fig. 28, it will spin round in the direction shown by the arrows; and if placed between two membranes vibrating in *like* phase, it will, when in the positions marked 1, 2, 3, 4 (fig. 29), turn in the direction shown respectively by the arrows. The movements of the currents of air in the case of two membranes in *unlike* phase are uncertain; as it is found that in one and sometimes in two of the places indicated in fig. 30, the current is reversed. This last figure represents an apparatus for exhibiting graphically some of the phenomena described. On a board, A, is fixed a wooden rim, *h*, and this forms a trough or receptacle for some viscous fluid, such as glycerine. In this trough are mounted two thin steel springs, *f* and *j*, about 1 centimetre in width. They are attached at their extremities to little frames by means of hinges, and they represent the vibrating membranes. By turning the small wheel, the cranks and connecting rods cause the springs to vibrate in *similar* phase; but if the crank rods are shifted to the positions shown by the dotted lines, then the vibrations will be in *unlike* phase. If a little bronze powder is mixed in the liquid, then effects represented by fig. 31 are produced; A being the effect for like, and B the effect of unlike phases. A double vane windmill (fig. 27 B), inserted in the liquid at various points, took up positions shown by the diagrams in fig. 32, the positions being in every case at right angles to the lines of force, the action being in fact that shown by fig. 33.

The effect of placing a small iron disc between the poles of two bar-magnets set opposite one another was illustrated with the effect shown by fig. 38. When the poles are made *unlike*, as in fig. 38 *b*, the disc is attracted from a distance to the centre or axis of the poles, and places itself in a line with the axis. When the poles are *like*, the disc is repelled from the centre, and moves to a position X or X^1 (fig. 38 *a*), and at right angles to their axis. In the case of membranes, the effects are the inverse of those which take place with magnetism, but the effect is not similar to paramagnetism, inasmuch as discs of any material are similarly acted upon by the membranes.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.—MAY 6th.

Prof. CLIFTON, President, in the Chair.

New Member—Mr. W. H. HEATON.

Mr. LECKY brought forward a form of battery, arranged by Mr. A. R. Bennett, of Glasgow, and which we fully described in our issue of February 18th.

Prof. GUTHRIE (in the absence of Dr. F. D. Brown, the author) gave a summary of a paper entitled "Notes on Thermometry." This described a method of calibrating the tubes by means of a microscope having an extra half-lens before the object-glass, which focussed the end of the mercury column whilst the other lens focussed the tube, so that no alteration of the focus of the microscope was necessary in making an observation. Dr. Brown also found that a constant zero temperature was better obtained from a mixture of ice and water than from drained ice; and that it was preferable to mix the ice with distilled water rather than ordinary water.

Acting on the suggestion of Dr. Guthrie, Mr. Whipple of Kew, had found that the ice itself might be from different sources without appreciably affecting the result.

Mr. WHIPPLE called attention to the change of zero in thermometers by heating, and recommended buyers to see that makers had not let them be heated after their calibration.

Mr. J. MACFARLANE GRAY suggested that the thermometers used by Regnault should be examined now, as our standards are based on his results.

Prof. CLIFTON pointed out that the half-lens in the microscope would probably distort the image of the mercury column.

Prof. GUTHRIE then read a paper on "The repulsion of a suspended horseshoe magnet by a rotating copper disc below it." He gave tables of quantitative results, and a plotted curve, showing that the repulsion varied as the square of the rate of rotation. For a surface velocity of the disc of 163 metres per minute, the repulsion was ·41 grammes.

CORRESPONDENCE.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Correspondence should arrive not later than Tuesday morning if it is desired to appear in the following number

FIRES AND THE ELECTRIC LIGHT.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—Let me call your attention to the total destruction by fire of the Aberdeen Market Buildings, and, specially, to the origin of the fire. A woman in charge of a basket-work stall, while lighting the gas with a taper, or while turning up the gas at the meter, with a taper in her hand, set fire to some of the stock. Damage £50,000. The bearing of the incident on the question of electric versus gas light is obvious. Yours, &c.,

May 1*st*, 1882. NORTHERNER.

TELEPHONE PATENTS.

To the Editor of THE ELECTRICAL REVIEW.

DEAR SIR,—On page 308 you gave us an abstract of a patent dated Sept. 12th, No. 3,944, W. E. Irish, on a new mode of winding the poles of a magnet. I beg to inform you that I wound both poles of a magnet with one coil in February, 1881 (I have the original), and substantially the same as set forth in his patent. The idea was suggested to me above six months before I tried it by Mr. Kinvig, Inspector of Telegraph Post Office here.—Yours truly,

GEORGE TOLMAN.

Wolverhampton, *May* 4*th*, 1882.

ELECTRIC LIGHT COMPANIES.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—I have watched with great attention the progress of electric lighting, and read with interest the appeals of the various companies to the public for money to carry on their schemes, more particularly, perhaps, as an investor.

Now, as an investor, the first thing that one looks at is—what has the company to offer, and at what price; and the second thing, what amount of business may be expected to come in, supposing that it got to work. I have understood fairly well the prospectuses that have lately appeared, but that now issued by the London and Provincial Electric Lighting and Power Generating Company fairly puzzles me.

The vendors offer to sell the public the Chertemps arc lamp, and an agreement they have enabling them to buy the Gramme machine and the British incandescent lamp of the English company, which now has these things to sell. For this arc lamp and this agreement the sum asked is £70,000 in cash and shares.

This seems to me to be an immense sum to want for an arc lamp and an agreement. I have looked at the matter from all sides, and can't make it out; can you help me? The questions that I cannot answer are—

1. Is this Chertemps arc lamp the same lamp covered by the English patent, numbered 3349, 1881, in which the only claims are for some improvements in the carbon holder?

2. Is not the description of this lamp that is entered in the prospectus of this company a description exactly such as is given in any of the text books of the old Serrin lamp?

3. Why does not the British Electric Light Company do all the work that this new company professes to do? Why should not the former do it direct for the public, instead of letting another company intercept the profit that they say they may make by virtue of their agreement? It seems to me that all this agreement means is that the British Electric Light Company only makes an agent of this new company, and not even a sole agent.

4. Is it not a fact that the Gramme machine patent expires in two years time, and after that becomes public property?

FESTINA LENTE.

[In answer to our correspondent's first query, we believe that the lamp in question is that described in the specification he mentions. We have examined this patent, and find that the first claim of Chertemps is for "the novel construction of carbon holders, capable of a twofold movement of adjustment, substantially, as, and for, &c." This adjustment, as described in the body of the specification, is simply for moving the upper carbon backwards, forwards, and sideways; this action, of course, forming one of the features of the old Serrin regulator. The second and last claim is "the arrangement of carbon holders, described with reference to the drawing, whereby I am enabled to use carbons of any desired length, the proper relation of their inner ends being maintained as set forth." This claim may be misleading to those who have not seen the specification, for although carbons of any length may be inserted into the holders, only a certain length can be burnt at a time—that is the portion between the clamps of the carbon holders. We understood on the occasion of our visit to the Atlas works, where this system is on view, that the burning of the lamp without readjustment would last for four or five hours.

To the second question we may answer that the report of the company's electrical engineer on the Chertemps lamp answers very well for the Serrin regulator.

The third inquiry of our correspondent is scarcely within our province, and we cannot, therefore, help him in this. We believe that he is correct in assuming that the Gramme patent shortly expires, and that doubtless an application for renewal would be strongly opposed.—ED. ELEC. REV.]

THE ELECTRIC LIGHT COMMITTEE.

HAVING once been appointed, the Electric Light Committee of the House of Commons selected the Hon. E. Stanhope as their chairman, and then adjourned for ten or twelve days to enable the various parties interested in the subject an opportunity of combining their forces, and so simplifying the proceeding, and at the same time reducing the number of counsel required. These results having been attained, the committee met for the first time for receiving evidence on Tuesday morning, in committee room No. 13. The members of this committee, which is of a hybrid character, are Mr. E. Stanhope (chairman), Mr. Boord, Mr. Brooke, Mr. Chamberlain (President of the Board of Trade), Mr. W. Fowler, Mr. Henderson, Mr. Molloy, Mr. Mitchell Henry, Mr. H. Northcote, Mr. Slagg, Mr. Whitley, Sir J. McGarel-Hogg, Mr. Alderman McArthur, Mr. Puleston, and Mr. Storey-Maskelyne. The object of this committee is to examine critically, with the help of favourable and adverse evidence, the Bill introduced by the Government, "To Facilitate and Regulate the Supply of Electricity for Lighting and other Purposes, in Great Britain and Ireland;" and to include in the inquiry the eight other Bills promoted by corporations or other bodies this session for a like purpose, each in a limited way. Some time before the hour fixed for commencing business, the committee-room was besieged by a crowd of gentlemen, more or less interested in the various schemes and the general subject, and throughout the sitting every inch of space in the room was occupied.

Notwithstanding the coalition that was understood to have taken place, there was a formidable array of counsel, including Mr. Rodwell, Q.C., Mr. Richards, Q.C., Mr. Pope, Q.C., Mr. Michael, Mr. Pember, Mr. R. S. Wright, Mr. Jeune, and several other well-known Parliamentary barristers. The private Bills referred to the committee were eight in number, and were promoted by the Anglo-American Brush Electric Light Corporation, the Electric Light and Power Generator Company, the British Electric Light Company, the Dublin Electric Light and Power Company, Siemens Brothers and Company, Edison's Electric Lighting Company; together with a Bill from Aberdeen and another from Dundee. Mr. Rodwell and his juniors took charge of all but the last two of these; while the other counsel mentioned appeared on behalf of petitioners, not only numerous, but varied in character, such, for instance, as the Commissioners of Sewers in the City of London, the Canal Association of England, the Lighting Association of Great Britain, the London and North-Western and the Midland Railway Companies, the Liverpool Corporation, the Municipal Corporations Association, and others.

Mr. Farrar, the permanent secretary to the Board of Trade, was the first witness, and he was called by the committee to explain the origin and objects of the Government Bill. Mr. Chamberlain, as the head of that department of the Government, although not chairman of this committee, naturally took the witness in hand, and, in answer to his questions, Mr. Farrar explained that the Board of Trade had been largely led to introduce this Bill by the fact that so many other schemes were being promoted for utilising electricity as a luminant and as a power. There were, he stated, four classes of these measures: the first of which proposed to empower companies to produce and supply in any district electric light and power, and to do whatever might be necessary for that purpose, subject, however, to the consent of the local authorities affected. The second class included eight Bills for enabling existing gas companies to supply light or power, but none of these, in his view, sufficiently provided for the regulation of the supply. By the third class of schemes, corporations or other local authorities now supplying gas were to be empowered to supply electric light and power—and one of these, the Dundee Bill, not only proposed to give the authority a virtual monopoly in regard to using streets, but absolutely forbade any one else to supply the electric light in their district; but no conditions were provided as to making the supply compulsory, or as to a preferential supply being given. Finally, there was the fourth class, which consisted of Bills promoted by corporations and other local authorities who do not at present supply gas. Since the report of the Select Committee on Electricity in 1879, which permitted certain powers with a view to experiments, seven Acts had been passed giving power to local authorities to supply electric lighting and power, and to raise the money required, but only for five years—except in the case of the Hull Electric Lighting Bill, which was agreed to for ten years. This Bill, in the first place, avoided interfering with the freedom of any person to make and use electric light or power on his own premises so long as he did not injure or annoy other people. The second aim of

the measure was to provide for experiments, for, although the question of the electric light had made great advances since 1879, it was still in the experimental stage. These experiments, it was thought, however, would not require any great length of time, and therefore a system was instituted by Clause 2, of licences for five years to be granted to local authorities, private companies, or persons, subject in the latter cases to the consent of the local authority. Stipulations were inserted to prevent anything like a preferential supply, and to guard people against being obliged to use any particular kind of lamp. Then again, lest a local authority should refuse consent to any private scheme from any interested motives, it was proposed that the promoters should be able to apply to the Board of Trade, and, on showing a good case, obtain a provisional order for any period. The Board of Trade were anxious to prevent the creation of monopolies as against the interests of the community, and therefore the time was unlimited in the case of provisional orders ; a local authority might, at the end of seven years, buy up a supplying concern, at the mere cost of its then value, without compensation for future profits. An analogous case to this was the Tramways Act of 1870, under which a similar proviso had been found to work satisfactorily. Having disposed of these and various minor provisions, Mr. Farrar, on the invitation of Mr. Chamberlain, turned his attention to the grounds of such opposition as had been offered to this Bill. The Electric Light Companies, among other things, suggested that the licences should be issued for seven years, instead of five, and should then be renewable ; that provisional orders should be granted for twenty-one years ; that in the case of any electric supply company's works being partly in one district and partly in another, the purchaser of the works should be obliged to purchase the whole, no matter how it stood as to districts. On the other hand, the local authorities desired to have a preferential right of local supply, as against private supply, and this claim would, he thought, be rather favoured by the Board of Trade. They further claimed that any monopoly of supplying gas which they now supplied should carry with it a monopoly of supplying electric light ; and on that point Mr. Farrar thought the ordinary governing body, whether now supplying gas or not, ought to have a priority in regard to electric light over private persons. The local authorities also desired that where any major district was supplying a minor district with gas it should have the same right in respect to electricity ; but in that view the Board of Trade did not agree. There were no other objections to the principle of the Bill.

Mr. Rodwell was invited to interrogate the witness on behalf of the Electric Light Companies, but he declined, on the ground that, so far, his only object was to see that the Bill was not materially altered to the prejudice of those companies. He would, therefore, wait to see whether any attack was made, and if necessary he would, later on, call scientific evidence.

Mr. Farrar was then subjected to a brief cross-examination by Mr. Richards, on behalf of various gas companies, and in answer to that learned gentleman he maintained the right of a "minor district" to free itself from a major district" if it wished in the matter of lighting by electricity, even though the larger district had previously supplied gas. He saw no objection to the public purse—that is, the ratepayers' money—being used against private capital in the hands of an individual or a company, holding it to be too late now to say that local authorities should not supply anything out of its own rates for the benefit of its ratepayers. He denied that gas companies had any actual monopoly, and defended the principle of the Board of Trade having power to grant provisional orders, warmly repelling an implied suggestion that such power would be used for purposes of favouritism. Finally he pledged himself that the Board of Trade would not act upon mere *ex parte* statements in granting either licences or provisional orders, and, having an admiration for the proposed issue of licences for experimental purposes, he expressed a strong objection to excising that part of the scheme.

Mr. Farrar was next examined in turn by several other counsel, and by the members of the committee individually, upon his previous statements and on the details of the Bill, and, while admitting here and there that certain minor provisions might be more clearly defined or introduced, he adhered on the whole to the main principle of the Bill, and reiterated his belief that no injustice was done by the measure to any existing interests.

The Chairman announced that Mr. Farrar was the only witness whom the committee would call, and the proceedings were adjourned to Thursday, to enable the petitioners and the Electric Light Companies to prepare their evidence, scientific and otherwise.

ELECTRIC LIGHT COMPANIES AND THEIR PROSPECTUSES.

ENORMOUS sums have this year been asked from the public on behalf of new companies proposing, in their prospectuses at least, to introduce some system or other of electric lighting. Since the 1st of January electrical companies have been registered whose authorised capitals combined amount to over £9,000,000. Now, allowing, liberally, for the sake of argument, that only one-half is issued, this amount of £4,500,000 would require, to pay a 5 per cent. dividend, a profit of £225,000. One of the leading companies having shown in its last balance-sheet an apparent profit of a very large sum, it seems to have opened inducements to some unscrupulous men to acquire agreements or patents, whether worthless or otherwise, for the purpose of promoting companies in which the vendors can be the only individuals either presently or eventually benefited. There are special reasons why the shares of the one leading company above mentioned are now unduly, we think, inflated. But for the prices of the shares of the subsidiary companies (which can have neither the advantage of manufacturing profits, as the parent company has, nor probably of again disposing so profitably of portions of their parts of the original licence) to be raised to an equal extent with those of the parent company, seems to us to be unreasonable, if not absurd. If members of the Stock Exchange undertake to deliver stock and there is not sufficient of it on the market, the price is sure to advance, especially when such stock is strongly held, as is the case with the shares of the leading electric light companies ; but, fortunately, the speculators primarily are the only ones likely to suffer for their own want of foresight. Seeing, however, that this artificial rise of prices, which has no relation to the real value, may afterwards lead —indeed, has led—to the introduction, amongst good and genuine concerns, of "bogus" companies, promoted by unscrupulous men, the public should be on their guard. Writing as we do, mainly for those in the electrical circle, it is not in our power to influence the general or outside public much ; but we cannot with honour be silent witnesses to what is at the present time taking place.

Lamps for which there are practically no patents by reason of their being but reproductions of older and probably better ones for which no patents exist; agreements for the purchase of machines good in themselves, but the patents for which are, by reason of their short remaining life, and also by reason of competitors, of comparatively little value, are brought forward and enormous sums named for the vendors' portion of the spoils. The public do not, we are afraid, inquire the value of such things. "The price of electric light stocks is in most instances at a premium, in some cases very large ; this one will probably follow the lead," so say they, and so for awhile the financial top spins. Even those who are ordinarily very shrewd in business matters deceive themselves with the thought that the enormous rise in prices is justified, for, say they, "There is an enormous field for electric lighting." That is so, but we are not quite so sure that electric lighting is equally certain soon to occupy it. Installations of sufficient magnitude to pay a profit on the amounts this year issued will require a considerable time to get into work before such profits can fairly be distributed.

We notice that of the public press in London, the *Daily News* and the *Times* speak with, and advise, caution regarding the new electric light companies, but the *Daily Telegraph*, of May 8th, says that "*very soon, when* (the italics are ours) the public will begin to adopt the new system for most of the purposes for which gas and steam have been employed, there will be ample work for *ten times* the existing number of companies." The said notice then finishes with a flourish from Mr. William Abbott. The electric light is rapidly pro-

gressing, the field for its introduction is immense, but its scientific progress and its introduction will be banefully influenced if the public are misled and sacrifice their money through the rigging of prices, or through the excessive cunning of unprincipled men.

NOTES.

THE CABLE SHIP "EDINBURGH."—We are informed that the steamship *Edinburgh*, belonging to the Eastern Extension, Australasian, and China Telegraph Company, is offered for sale or charter. The *Edinburgh* is a steamer of 300·5ft. by 39·8ft. by 25ft., and of 275 horse-power, steaming 11 knots. Her gross tonnage is 2,315 tons. She was built at Glasgow in the year 1855, but last October was fitted with new boilers, crank-shaft, deck-houses and decks, and a general overhaul was made. She is fitted with water-ballast tanks, and strong iron tanks for telegraph purposes.

THE LIZARD-BILBAO CABLE.—The steamship *H. C. Œrsted*, chartered by the India-Rubber, Gutta-Percha, and Telegraph Works Company for the repairs of the Lizard-Bilbao cable, arrived off the Silvertown Works, from Copenhagen, on Monday, the 8th instant. After shipping the necessary cable, buoys, ropes, &c., coals and stores, she left the Silvertown moorings on Tuesday afternoon, the 9th, and sailed straight for the ground where the repairing operations will take place.

THE CABLE SHIP "DACIA."—The India-Rubber, Gutta-Percha, and Telegraph Works Company have received information that their steamship *Dacia* arrived at Bahia on the 18th ult., and may be expected to arrive at Liverpool to-morrow, the 14th inst.

THE CABLE SHIP "FARADAY."—The steamship *Faraday* left Messrs. Siemens Bros. and Co.'s Works, at Charlton, on Saturday, the 6th inst. We are informed she proceeds direct to the Atlantic to complete Jay Gould's cables.

THE BONE-BISERTE CABLE.—The French Government telegraph steamer *Charente* arrived off the Silvertown Telegraph Works on Friday, the 28th ult., and on Monday, the 1st inst., commenced shipping the cable manufactured by the India-Rubber, Gutta-Percha, and Telegraph Works Company for the French Telegraph Administration. On the completion of shipment of cable, and after taking the necessary coals, &c., on board, the *Charente* sailed for Bone on Wednesday, the 10th inst., at daybreak.

M. Rambaud, Ingénieur des Télégraphes, represented the French Telegraph Administration during the operations of making and shipping the cable, and goes out in charge of the cable on board the *Charente* until her arrival at Bone. The ship will there be joined by M. G. Amiot, Ingénieur des Télégraphes, Chef du Service des Câbles sous-marins, under whose superintendence the cable will be laid.

The *Charente* is a screw-steamer 220 ft. by 29·5 ft. by 16·4 ft., with engines of 130 horse-power, and steaming about 9 knots. She is fitted with three iron cable-tanks and a couple of wooden skeleton tanks for grappling and buoy ropes. She carries on her decks separate picking-up and paying-out machinery, and is also fitted with Sir William Thomson's wire-sounding machine, supplied by the Silvertown Telegraph Works.

The *Charente* is commanded by M. Dufour, lieutenant de vaisseau, assisted by Lieutenant Roux. Her crew consists of seventy hands all told, and whilst on cable work she further carries three or four leading cable hands belonging to the Telegraph Administration.

THE CABLE SHIP "RETRIEVER."—WE have received the following extract from the *Panama Star and Herald*, March 11th, 1882:—"The repairing steamer *Retriever*, belonging to the West Coast of America Telegraph Company, under the command of Captain Morton, arrived in this bay early yesterday morning (Friday, March 10th, 1882). She is at present engaged by the well-known Submarine Cable Manufacturers, 'The India-Rubber Gutta-Percha and Telegraph Works Company, Limited,' of Silvertown, London, to make the preliminary survey of soundings, &c., for the proposed extensive system of cables which this firm has undertaken to lay for the Central and South American Telegraph Company of New York. Mr. E. Parsoné is entrusted with this portion of the work, assisted by Mr. J. K. Gray, Mr. G. A. Darling (Analytical Chemist), and Mr. C. T. Hawkins (Draughtsman). The *Retriever* will leave at an early date to complete the survey between this port and Salinas Cruz, Mexico. Mr. Robert Kaye Gray may be expected to arrive on the Isthmus about the 22nd of this month; this gentleman has entire charge of this big undertaking, both at home and abroad."

THE CABLE SHIP "INTERNATIONAL."—The Silvertown Telegraph Works inform us that their s.s. *International*, after leaving Gravesend on Thursday, April 27th, at 4·30 p.m., put into Portland, owing to the heavy weather she met with in the Channel, and remained there until the 2nd inst., when she continued her voyage to Kingston, Jamaica.

EARTH CURRENTS.—In our issue of the 29th April we spoke of the interruption of telegraphic communication in Scotland, through the appearance of earth currents, which lasted with more or less vehemence from the morning of the 17th to the 19th ult. It may interest our readers to know that the Lizard-Bilbao Cable of the Direct Spanish Telegraph Company was affected in a like manner. On the 17th ult. these currents were strongest from 4 a.m. to 6 a.m., from 8 a.m. to 9 a.m., and at intervals during that day. On the 20th ult. they were again very strong after 3 a.m., until 8 or 9 p.m. Since then they have gradually disappeared.

TELEPHONIC COMMUNICATION BETWEEN EDINBURGH AND GLASGOW.—Arrangements have been made with the Postmaster-General to establish through communication between the National Telephone Company's telephonic exchanges in Edinburgh and Glasgow. The arrangement limits this facility in the meantime to eight subscribers—four in each town—who will have the right of calling any member on both exchanges. The subscription will be £110 per annum.

LIEUT.-COLONEL WEBBER ON THE TELEPHONE.—In lecturing before the members of the Society of Arts on "Telephonic Communication," Lieut.-Col. Webber touched upon several points worthy of reproduction. In referring to the report of the Count du Moncel, who acted as technical adviser to the International Jury of the Paris Universal Exhibition in 1878, the following passages are found in connection with the rival claims of Messrs. Gray and Bell for the invention of the telephone:—

"1. That the two inventors had, at the same time, the idea of reproducing speech with the assistance of undulatory currents.

"2. That Mr. Gray was the first to discover the way to solve the problem.

"3. That Mr. Bell only succeeded after 'trials,' and these almost casually referred to in the last sentence of his claim.

"4. That the two inventors' systems are different, in that one uses a battery, while the other uses only the induced currents resulting from the use of a magnet.

"5. That while Mr. Gray was the first to solve the problem, Mr. Bell was the first afterwards to give it a practical and convenient form.

"6. That the invention of Mr. Gray gave birth to the telephone of Mr. Edison, which itself was the progenitor of the microphone."

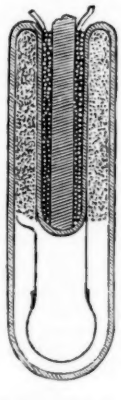
The jury awarded on this evidence the highest honours to the three great discoverers, Bell, Gray, and Edison. The lecturer then remarked that in such matters as these we find men forgetful of the past, even of their own statements made on evidence never contradicted, and he quoted the fact that in February last the Count du Moncel published an article in *La Lumière Electrique* on the discovery of the telephone, in which he bestowed all the honours as the inventor and discoverer of the telephone on Professor Bell alone. The Lieut.-Col. said that, so far as carbon is concerned as a means of acting as the mediatory for the emission of undulatory currents, its use is due to the discovery of Clerac some fourteen years ago, a discovery which is the foundation of that of all the carbon telephone transmitters.

EXHIBITION OF THE ELECTRIC LIGHT.—On Friday evening, the 5th inst., we took the opportunity of viewing the installation of the London and Provincial Electric Lighting and Power Generating Company at the Atlas Works, Webber Street, Waterloo Road. This company is formed for working the "British" incandescent lamp and the "Chertemps" arc lamp with the Gramme dynamo-electric machine. When we visited the works there were only twenty incandescent and three arc lamps, these latter, however, being worked only one at a time. Two Gramme machines were employed of the "A" type, driven from a 12 horse-power nominal Otto gas-engine, which, however, in this instance behaved so badly that we cannot criticise the behaviour of the lamps. We may say, however, that we doubt the efficiency of the "Chertemps" lamp as compared with several other well-known and successful inventions. In our correspondence column will be found an important letter dealing with this company's prospectus, in reply to which we have fully dealt with the various points brought forward. We notice that in the description of the Chertemps lamp by the company's electrical engineer, and which is attached to the prospectus, it is stated that the lamp as described is intended to work singly, *but with proper modifications can be easily made to burn in series* (the italics are our own). We think that this report does not enhance the value of the lamp.

DIEHL'S INCANDESCENT ELECTRIC LAMP.—We illustrate a new incandescent electric lamp, patented by Mr. P. Diehl, of Elizabeth, New Jersey, U.S.A. The idea of the inventor, which is ingenious as far as the globe is concerned, can best be conveyed by the words of his specification, which are as follows:—

One of the main objections of electric vacuum lamps, based on the principle of incandescence, consisted in the leakage of the lamps, as owing to the difference in the expansion and contraction of the glass globe and of the conducting wires, air will gradually get in and destroy the vacuum established therein, so as to render the lamp useless.

The object of this invention is to furnish an improved electric lamp, based on the principle of incandescence, in which the light-giving part of the lamp is inclosed within an evacuated and hermetically sealed glass globe, without any wires passing through the body of the globe to the interior of the same. And the invention consists of an electric lamp, composed of a hermetically sealed glass globe, and a light-giving part, supported at the interior of the globe, and placed in circuit with a secondary coil, which is arranged within an extension made integral with the globe, and placed in inductive relation to a primary coil exterior of the lamp.



The accompanying drawing represents a vertical transverse section of my improved electric lamp. The carbon filament or other light-giving part is held between the terminal wires of the secondary coil, so as to be in the same circuit therewith, said light-giving part being made of any desired shape and material, and connected in any approved manner to the conducting wires. The primary coil is connected by the conducting wires with the poles of a magneto or dynamo-electric machine, arranged for alternating currents, or with a battery or other source of electricity. In the latter case an automatic current-breaker has to be placed in the circuit.

The change of polarity, or the closing and breaking of the current in the primary coil, will induce currents in the secondary coil at the inside of the lamp, the rapid succession of which will heat up the light-giving part to incandescence, and establish thereby a steady and reliable light, that is not liable to the interruptions caused by the gradual destruction of the vacuum, and that will consequently be of much longer duration, owing to the entire absence of leakage.

Mr. Diehl states in a letter to us that some of these lamps are in use and giving satisfaction; we, however, cannot see any extensive employment for them, as other systems will answer the purpose better both as regards first cost and economy of working.

REPORT ON ELECTRIC LIGHTING.—We have been favoured with the report of the joint deputation from the "Purchase of Property Committee," the "Gas Committee," and the "Free Library Committee" of the Borough of Leeds, on electric lighting. In preparing the report the intention has been merely to attempt to collect together in a convenient form, for the information of the members of the council, as much general information as possible upon the subject. It consists, as the above remarks would indicate, chiefly of extracts culled from the daily press and scientific journals, and it forms a very interesting and readable book of 135 pages. Almost every system of arc and incandescence is touched upon—dynamo-electric machines, cost of working, fire risk attending electric lighting, the Crystal Palace Exhibit, and many other topics—the combination forming a work which, had it been issued as a popular description of electric lighting, would probably have had a wide circulation. We are, however, afraid that the insertion of the article in the appendix, "How the electric light is produced," will be the cause of more uncertainty in this respect amongst the members of the council than may at present exist. The conclusion arrived at by the deputation is to the effect that further important discoveries will yet be made tending to still greater perfection in the science of lighting. Therefore the deputation is of opinion that it would not be desirable hastily to adopt for a permanency any system of electric lighting now claiming public attention.

THE EDISON ELECTRIC LIGHT.—Mr. Johnson, as representative of Mr. Edison in this country, delivered a lecture in the Concert-room of the Crystal Palace on Wednesday evening, the 3rd inst., his object being to explain in a popular manner the entire Edison system of production and distribution of electricity for lighting and motive power. He alluded to the phonograph as being the invention which brought Mr. Edison's name prominently before the public, and said it was not till 1878 that his thoughts were turned to the subject of electric lighting. In reference to the reports in the newspapers at that period and the great panic and dealings in gas-shares, he declared that Mr. Edison had no share in such transactions, which occurred without his sanction. Speaking of incandescent electric lamps, the lecturer went on to say that he would not enter into the question of legal rights generally, as the Courts of Law only could settle that, but he might safely state that no one had ever accused Mr. Edison of appropriating the invention of any other person. In his remarks on dynamo-electric machines, Mr. Johnson said large machines must necessarily be employed for public purposes, and he expected one shortly from America which would keep 2,600 lamps going at once. To be economical—the most important point commercially—no current must be wasted, and therefore the only way of connecting the machines and lamps was in multiple arc, thus securing the individuality of each lamp. Although in series less copper was required for conductors, that plan was as expensive as ever when the lamp was out—the same current had to be sent through the line, and the consumer had to pay for it whether he needed the light or not. He claimed for Edison's system, in its entirety, simplicity, economy, perfect safety, both from danger of fire and accidents to human beings, more freedom from trouble even than gas, and that with the electrolytic meter the consumer would only pay for the exact amount of current passing through his circuit; also by an automatic resistance at the central station the lamps in the whole circuit or district are kept at a regular candle-power. Mr. Johnson concluded his lecture with a few observations on Edison's electric railway.

ELECTRIC LIGHTING COMPANIES.—In the city article of the *Times* of the 9th inst., we observe that M. Gaudet raises objections on behalf of the "Compagnie Générale d'Electricité," to the prospectus issued by the London and Provincial Electric Lighting and Power Generating Company; asserting that this latter company indirectly attributes to

itself something belonging to the former, or in other words a distinction has not been made between the ordinary Gramme dynamo-electric machine and the alternating current Gramme, which is the property of M. Gaudet's company. We also notice a letter from the Secretary of the Anglo-American Brush Electric Light Corporation referring to the prospectus recently issued by the Gülcher Electric Light and Power Company. In speaking of the subsidiary companies formed for working the "Brush" system, he states that he is instructed by his directors to say that "the very fact of so many countries, districts, and counties having been thus covered by one substantial and successful company, rather tends to detract from the benefits that are likely to be derived in the future by other companies." We trust that this statement will have the reverse effect to what is doubtless intended, and hope that other companies with good systems will enter the field of electric lighting with all the greater energy and determination to succeed.

FIRE RISK AND THE ELECTRIC LIGHT.—Messrs. Crompton and J. E. H. Gordon, in a letter to the *Times* of the 10th inst., give the rules of the Phœnix Fire Insurance Office for electric light installations, compiled by Mr. Heaphy, C.E., and which read as follows :—

1. All rods or wires in a building to be so placed as to be thoroughly and easily inspected.
2. All rods and wires to have sufficient sectional area, so as to allow at least 50 per cent. more electricity being safely sent through them than will ever possibly be required for the lights they supply.
3. All main rods (or wires) should be thoroughly well insulated with a material rendered as non-inflammable as possible, and further protected by coverings of a substantial and durable character. Wherever practicable the rod (or wires) should be enclosed in iron, brass, lead, terra-cotta, or earthenware pipes, the space between the rod (or wires) and the pipe being completely filled with a high insulating compound. Or the rods (or wires) should be thoroughly well insulated with a material as non-inflammable as possible, and might be placed in slate beading or slate boxes. To be approved by the inspector from the fire office.
4. The wires for "arc lights" to be insulated and protected in the same manner as the aforesaid main rods or wires. The wires, unless inclosed in pipes or slate boxes, &c., as described under requirements No. 3, should be laid at least eight inches from each other, and eight inches from all other wires, metal, or conducting substances. Or where this from the nature of the case is impossible, then the wires must be kept at least one inch apart, and one inch from all conducting substances by a continuous rigid non-conducting material, to be approved by the inspector from the fire office.
5. The wires for the incandescent lights should be at least two-and-a-half inches from each other, and two-and-a-half inches at least from all other wires, metal, or other conducting substances; they must be thoroughly well insulated with a material rendered as non-inflammable as possible, and protected by coverings of a substantial and durable character; and where external injury is possible they should be insulated and enclosed in iron, lead, brass, terra-cotta, or earthenware pipes, or in slate beading or slate boxes, in the manner described in requirements No. 3 for the main rods.
(In non-hazardous risks the wires, having been thoroughly well insulated with a material rendered as non-inflammable as possible, should, where practicable, be enclosed in wood beading, and the wires kept apart by a continuous fillet of wood at least one inch wide.)
6. All rods or wires passing through floors or partitions must be insulated, and enclosed in iron, brass, terra-cotta, or earthenware pipes, or slate beading, in the manner described under requirements No. 3.
7. All rods or wires passing through the exterior walls of buildings must be insulated and enclosed in pipes as described in requirements No. 3, and the insulated material must be impervious to moisture.
8. All rods or wires in a building that are exposed to moisture must have a waterproof covering to their insulating material.
9. The fastenings of all rods or wires to be composed of an approved non-conducting material.
10. Any material employed for conducting the electricity in lieu of rods or wires must be protected in the same manner as the before-mentioned rods or wires.
11. All lamps, switches, or any bare connections must be so mounted that leakage of electricity from them is rendered impossible.
12. When two wires are joined together the junction must be soldered, or secured by a thoroughly clean binding screw or clamp.
13. Wherever a branch wire is led off the main conductor to supply current for one or more incandescent lamps, a short length of lead or other fusible wire must be inserted between the main conductor and one end of the branch; and the lead wire must be of such section and nature that if the current passing through it exceeds the normal current by 50 per cent., then it will fuse and disconnect the branch.
14. No naked lights allowed. If "arc lights" are used, the globes must be enclosed at the base, and have chimneys so arranged that no sparks or flame can escape. The globes must also be covered round with wire netting.
15. All "connections," "cut outs," or "resistance coils" must be placed in such a secure manner that no danger can arise in the event of their heating.
16. A shut-off must be placed at the point of entrance to each building.
17. No ground circuit allowed.
18. All work is to be of a substantial character, and put up in a thorough workmanlike manner, and to be accurately tested at the time of erection for insulation.
19. When the "electric light" is intended to be used, information must be supplied of the particular system of lighting that is to be adopted; how and where the electricity is to be generated; the number and kind of lamps used; the quantity of electricity to be conveyed through the wires; the conductive capacity of the wires; method of insulation; whether there is to be metallic circuit; and as far as possible full details of the manner in which it is proposed to equip the building.

Messrs. Crompton and Gordon believe that if certain definite and well-understood rules are observed in arranging the installations of the electric light, it is absolutely safe from risk of fire, and that although electricity is now supplied on a small scale only, it will in a very short time be supplied on at least as large a scale as gas or water.

UNDERGROUND CABLES FOR THE ELECTRIC LIGHT.—In writing to the Philadelphia *Times* on the employment of underground wires for electric lighting, Mr. David Brooks says :—

To the Editor of the *Times*.

In to-day's issue of your journal is an article headed "Extending the Electric Lights," from which I quote as follows :—

Mr. Nandusen wanted to know if the company couldn't adopt an underground system, instead of erecting poles.

"Certainly," replied Mr. Dolan. "If any man or men will come to this company to-day and show us to our satisfaction that any of these so-called underground systems is a success I will give him my cheque for 100,000 dols. There is 20,000,000 dols. capital represented by the ten gentlemen in this company, and if we could get a thorough and satisfactory system of underground wires we wouldn't go into the expense of erecting poles and afterwards pulling them down."

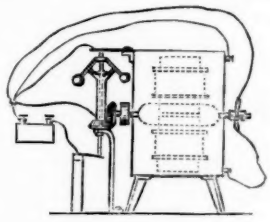
It was stated that no exclusive privileges were demanded, and the meeting then adjourned. The sub-committee will visit New York on Tuesday and examine into the electric light system of that city.

If Mr. Dolan and the sub-committee will call on me when they come to New York I will show them an underground system that I am now laying between Jersey City and Newark, which I will guarantee to work as well or better for electric lights than his system of poles and wires that now grace Chestnut Street, and he need not open his purse or draw his cheque for one cent.

There are other good systems which I will guarantee if I can be allowed to put them down. London and Paris are much better lighted with electric lights than Chestnut Street, and no poles or over-head wires are used. "To our satisfaction" is a very convenient way to get out of a small extra first expense.—Yours, &c.,

Astor House, New York, April 21. DAVID BROOKS.

MEANS FOR CHARGING SECONDARY BATTERIES.—Patent No. 255,248. Filed in the United States of America Patent Office, January 13th, 1882.—By Charles E. Buell.



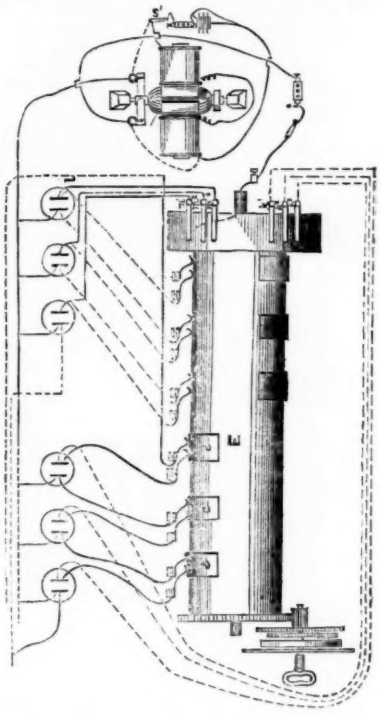
Claim.—1. The combination of a dynamo-electric machine, a developing circuit, on which the machine is worked temporarily, a main charging-circuit, including one or more secondary batteries, and means, substantially as described, for dividing the current through the developing circuit and the main charging-circuit, and then breaking the developing-circuit while the main charging-circuit remains closed.

2. The combination, substantially as described, of a dynamo-electric machine, a developing-circuit, a main charging-circuit, including one or more secondary batteries, and automatic switching devices, substantially as described, normally completing the developing-circuit, and operating, when the machine is in motion, to make connection with the main charging-circuit without breaking the developing-circuit, and then to break the developing-circuit and keep the main charging-circuit closed, and when the machine slackens and stops to perform the said operations in reverse order, whereby the wasting of the charge of the secondary batteries is prevented when the machine is at rest.

3. The combination, substantially as described, of a dynamo-electric machine, a developing-circuit containing an adjustable resistance, a main charging-circuit, including one or more secondary batteries, and switching devices, substantially as described, for dividing the current through the developing-circuit and the main charging-circuit, and then breaking the developing-circuit while the main charging-circuit remains closed, all as set forth.

MEANS FOR CHARGING AND DISCHARGING SECONDARY BATTERIES.—Patent No. 255,249. Filed in the United States of America Patent Office, December 28th, 1881.—By Chas. E. Buell.

Claim.—1. The combination, substantially as described, of a charging-circuit including a dynamo-electric machine or battery, two



series or secondary batteries, each of which series is composed of two or more pairs of plates, a working-circuit common to both series, and a switching device for alternately connecting the pairs of one series successively to the charging-circuit, and at the same time discharging the pairs of the other series into the working-circuit in tension series.

2. The combination, substantially as described, with an electrical generating machine, of a charging-circuit which includes the helices of the field-of-force magnets, a separate exterior charging-circuit which includes the helix of the armature, a working-circuit, two series of secondary batteries, and devices, substantially as described, for alternately placing the pairs of each series in the exterior circuit of the machine to be charged and in the working-circuit to be discharged.

3. The combination, with an electrical generating machine, of a charging-circuit which includes the helices of the field-of-force magnets, a separate exterior charging-circuit which includes the helix of the armature, a working-circuit, two series of secondary batteries, and switching devices for alternately placing the pairs of each series successively in the exterior charging-circuit to be charged, and in the working-circuit in tension series to be discharged, whereby the reversal of the magnetic condition of the machine by backflow from the batteries is avoided, and the loss of charge from the backflow of the batteries, if the generator slackens speed or stops, is confined to one pair of plates.

4. The combination, with an electrical generating-machine, of a charging-circuit which includes the helices of its field-of-force magnets, a separate exterior charging-circuit which includes the helix of the armature, a working-circuit, two series of secondary batteries, and devices for placing each series alternately in the exterior charging-circuit of the machine to be charged and in the working-circuit to be discharged, and independent means for separately regulating the circuits which include the armature-helix and the field-of-force magnets, substantially as described.

ELECTRICAL ENGINEERING.—In connection with the Crystal Palace Company's School of Art, Science, and Literature, is added a department for the preparation of those entering the electrical engineering profession. Professor W. E. Ayrton distributed the certificates to the students of this school last Saturday week, and addressed the assembled students in a speech which was listened to with great attention. He informed them that it is no more possible to learn electrical science out of a book than it is possible to acquire proficiency in bicycling in an arm-chair; and that, in a word, while an ordinary course of lectures will teach a good deal about the electric light, it will require as systematic a course of training as that of other professions to succeed as an electrical engineer.

FIRE RISKS INCIDENTAL TO ELECTRIC LIGHTING.—A lecture, illustrated by experiments, was delivered at the rooms of the Society of Arts, on Wednesday evening, the 3rd May, by Mr. Thomas Bolas, F.C.S., on "The Fire Risks Incidental to Electric Lighting." The lecturer showed that coal gas might be ignited by the smallest electric spark, and that gutta-percha and other substances commonly used for insulating electric wires might be fired by irruptive discharges of electricity. The different characters of the currents employed for arc lights and for incandescent lamps were explained, and incandescent lamps placed against muslin curtains were broken to prove that there was no danger of a fire from such an accident. Mr. E. J. Paterson showed how an incandescent lamp fitted in a red lamp might be used for safety in the photographer's studio, with a small portable battery of his invention. There were, no doubt, the lecturer said, in concluding, dangers in the employment of electricity for lighting, but with reasonable precautions he believed electricity might be used more safely than gas. Mr. W. H. Preece, F.R.S., who presided, remarked that while he had in the columns of the *Times* called attention to some dangers which had to be guarded against in the use of electricity, there was no reason why those who could make the lightning harmless should not control machine currents. Properly and scientifically employed electricity afforded a means of artificial illumination which could be rendered absolutely and perfectly safe. Mr. Preece, in proposing a vote of thanks to Mr. Bolas, suggested that it would greatly contribute to the comfort of timid householders if the electrical lighting companies and the fire offices would agree upon a set of rules having the approval and sanction of several leading and well-known electricians.

THE JURORS AT THE CRYSTAL PALACE.—It is said that Messrs. Siemens and Swan have declined to have their electric light exhibits judged by the jury as now constituted.

THE SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.—An extraordinary general meeting of the Society of Telegraph Engineers and of Electricians will be held on Thursday, the 18th inst., when, by special desire of the President and Council, Mr. Augustus Stroh, member, will repeat his interesting experiments in connection with attraction and repulsion due to sonorous vibrations, and will compare the phenomena with those of magnetism.

NEW COMPANIES REGISTERED.

INDIAN AND ORIENTAL ELECTRIC STORAGE AND WORKS COMPANY, LIMITED.—Capital £400,000 in £5 shares. Objects: To acquire and use inventions relating to the storage and distribution of electric power. Signatories (with one share each): *Ernest Noel, M.P., 29a, Grosvenor Square; *Earl of Crawford and Balcarres, 47, Brook Street; W. M. Bullivant, 72, Mark Lane; Col. F. G. Steuart, 14, St. James's Square; *J. S. Trotter, 2, Walton Street, S.W.; Arnold Trinder, 14, St. Helen's Place; T. M. Collett, Winchester House, Old Broad Street. Directing qualification, 100 shares. Mr. Alex. McArthur, M.P., and Major C. H. Strutt are members of the first board. Minimum remuneration, £1,500 per annum. Registered 3rd inst. by Trinders and Curtis-Hayward, 4, St. Helen's Place, E.C.

"BRUSH" MIDLAND ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £250,000 in £5 shares. Office, 31, Lombard Street. Objects: To acquire licences from the inventions of the Anglo-American Brush Electric Light Corporation, Limited, for the use of their inventions. Signatories (with one share each): A. W. F. Greville, Sunninghill; Hutton Vignoles, C.E., 1, Westminster Chambers, S.W.; H. N. Myers, 21, St. James's Road, Brixton; J. D. Shakespear, J.P., Empire Club; F. G. Painter, 2, Moorgate Street Buildings; Henry Russell Evans, Newport, Monmouth; W. Graham Lawson, Oxford and Cambridge Club. Directing qualification, £250 in ordinary shares or stock; remuneration, £1,000 per annum. Registered 4th inst. by Ingledew and Ince, St. Benet Chambers, Fenchurch Street.

LONDON AND PROVINCIAL ELECTRIC LIGHTING AND POWER GENERATING COMPANY, LIMITED.—Capital £250,000 in £5 shares. Objects: To acquire inventions relating to electric lighting and the transmission of electric power. Signatories (with one share each): F. Bracher, 116, London Wall; R. B. Coe, Imperial Buildings, Ludgate Circus; R. Sanford, Harlesden; M. F. Dormer, 6, Fernlea Road, Balham; T. B. Roughan, 16, Thornhill Crescent, Barnsbury; G. H. Cowan, 34, Eastcheap; A. C. Murray, 30, Pembroke Square. The directors are Lord Wallscourt (Chairman); W. M. St. Aubyn, M.P.; Gen. Hamilton, R.E.; the Hon. Lincoln Stanhope; J. D. Massey; and E. H. Bayley. Remuneration, £2,500 per annum. Registered 8th inst. by E. Lee, 1, Gresham Buildings.

PROVINCIAL (BRUSH) ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £200,000 in £5 shares. Objects: The ordinary business of an electric light and power company. Signatories (with one share each): Gen. M. K. Kennedy, R.E., 26, Leinster Square; F. Tesser, 32, Cambridge Gardens; C. Wapshawe, South Norwood; R. Cunningham, Kingston Hill; G. Offor, 24, Crutched Friars; T. Fry, Manor Park, Lee; E. F. Grainge, 4, Addington Street, Lambeth. Directing qualification, £250 in shares or stock; remuneration, £1,000 per annum. Registered 8th inst. by Walter Webb and Co., 23, Queen Victoria Street.

ELECTRIC CARBON STORAGE AND APPARATUS MANUFACTURING COMPANY OF SCOTLAND, LIMITED. — Capital £150,000 in £1 shares. Office, 10, Cannon Street. Objects: To carry on any business connected either directly or indirectly with electricity. Signatories (with one share each): Arthur Roberts, 25, Hatcham Park Road; W. C. Rattenby, 53, Shakespeare Road, Brixton; G. de Maid, Balham; F. W. Fullilove, Catford; T. Wright, 7, St. Paul's Place, Canonbury; B. J. Weldbore, 3, Bank Terrace, Mile-End Road; W. Lake, 23, Acklam Road, North Kensington. Directing qualification, 300 shares. The first are D. R. Ratcliff, J. Percy Leith, J. D. Fraser, W. P. Hope, T. Landale, and E. Mather. Remuneration: £250 per annum to the chairman, and £100 each director. Registered 9th inst. by Pattison, Son, and Co., 3, Castle Street, Holborn.

* Signatories whose names are preceded by an asterisk are also directors.

NEW PATENTS—1882.

2107. "Improvements in electric safety apparatus for theatres, warehouses, and other structures made applicable automatically in case of fire." P. JENSEN. (Communicated by R. J. L. Haviland.) Dated May 4. *Complete.*

2123. "Regulating and utilising electric currents." W. ARTHUR. Dated May 5.

2125. "Improved method of producing electric currents for general purposes." K. PARZELSKI. Dated May 5.

2135. "An improved process for forming or preparing lead in the shape of plates or otherwise for secondary batteries or magazines of electricity and an improved construction of battery." T. CUTTRISS. (Partly communicated by C. Cuttriss.) Dated May 6.

2136. "Incandescent lamps." J. RAPIEFF. Dated May 6.

2138. "Apparatus for producing electric currents, also applicable for electro-motive power purposes." A. MILLAR. Dated May 6.

2144. "Electric lamps." J. H. JOHNSON. (Communicated by J. M. A. Gérard-Lescuyer.) Dated May 6.

2184. "Electro-magnetic and magneto-electric engines." C. F. VARLEY. Dated May 9.

2185. "Electro-magnetic and magneto-electric engines." C. F. VARLEY. Dated May 9.

2186. "Incandescent electric lamps." H. LEA. Dated May 9.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

4193. "Electric lamps." C. H. GIMINGHAM. Dated September 29. 4d. Relates to incandescent electric lamps, and has reference to an improved mode of connecting the carbon filament to the terminals in the lamp. According to the invention the inventor flattens the ends of the terminals (composed of platinum or other suitable metal) and forms the flattened ends into a tube by drawing them through a wire plate, and mounts the carbon filament directly in these tubes without any further preparation, it being held or gripped sufficiently by the combined spring of the carbon itself and the metal tube.

4227. "Insulators for animal magnetism." JOHN LYON. Dated September 30. 4d. Consists in forming insulators of the most perfect resinous kind. Resinous insulators are too brittle to stand alone, while glass has not sufficient insulating power, the inventor therefore makes the body of the insulator of glass, and preferably rectangular, with rounded edges so that it may pack easily. On one, two, or, if desirable, three or more sides of the cube or rectangle it is hollowed out so as more easily to retain the foot of the article it has to support. In the hollowed side or sides is cut out a dove-tailed or other hole or holes filled with resinous non-conductor, such as a mixture of resin and shellac in equal parts.

4294. "Manufacture of incandescent electric lamps." A. G. SCHAEFFER. Dated October 4. 2d. Consists in providing arrangements by which the glass may be sealed before exhaustion. This is accomplished by the introduction of a small metallic pipe through which the air is finally exhausted, and which is closed up after exhaustion. The inventor prefers to make this pipe of platinum, and of a very small diameter, and to employ it as one of the supports for the incandescent carbon and one of the electrical conductors, just as a wire is now ordinarily used, but it may be made independently. By this means increased facility of manufacture is obtained, and the unsightly appearance given to many of the lamps in use by the projection of a part of the globe used for sealing obviated.

4296. "Conduits for telegraphic or telephonic conductors laid in streets or roadways." C. D. ABEL. (A communication from abroad by Léon Alexandre Brasseur and Octave Dejaer, both of Brussels.) Dated October 4. Relates to an improved construction of conduits or recipients for telegraphic or telephonic conductors that are laid in streets or roadways whereby such conductors are rendered readily accessible at all times along their entire length for inspection or repairs. (*Provisional only.*)

4305. "Electric lamps." H. J. HADDAN. (A communication from abroad by Léon Somzeé, of Brussels.) Dated October 4. 2d. Consists chiefly in constructing electric lamps, made luminous by incandescence, as well as by the voltaic arc, by means of continuous or alternating currents which produce the incandescence of a thin rod (preferably of carbon) and a voltaic arc at the circumference of a rod of refractory material, which may be fixed or movable on the second electrode of large section. (*Provisional only.*)

4309. "Galvanic or electric batteries." F. WIRTH. (A communication from Dr. Julius Stebbins, of New York.) Dated October 4. 6d. Relates to that class of galvanic or electric batteries in which porous cells or partitions are used to separate two liquids of different specific gravities. The objects of this invention are to produce a battery combining great quantity and intensity with a long endurance, and to enable the force of the battery to be regulated at will. These results are attained, first, by constructing the inner cell with an upper comparatively contracted compartment inclosed by a porous wall, and opening into a low enlarged reservoir inclosed by a non-porous wall, arranging in the upper compartment a battery plate of such form and dimensions that but a thin body of fluid can have place between its surfaces and the porous wall, and locating on opposite sides of said upper compartment two battery plates of opposite character to the first, and in such close proximity to its porous walls that but a thin body of liquid will stand between them and said walls.

4311. "Electric lamps." J. H. JOHNSON. (A communication from abroad by Camille Alphonse Faure, of Paris.) Dated October 4. 6d. Relates to electric lamps in which light is obtained by incandescence, and has reference to the production of the carbon itself; also to holders for carbons; also to the provision of means whereby the carbon may be removed without the destruction of the body of the lamp; and further, to improved means of exhausting the lamp and effecting its hermetic closure.

4383. "Electric bridges for incandescent lamps, &c." ST. GEORGE LANE FOX. Dated October 8. 6d. Has reference to the process of manufacturing electric bridges for incandescent lamps by immersing baked threads or other suitable fibres in an atmosphere of coal gas or other carbon compound, and sending an electric current through them so as to raise them to a white heat and cause the carbon of the hydro-carbon atmosphere to become deposited upon the surface of the bridges, thereby reducing them to a definite or specified resistance.

4409. "Manufacture of telegraph conductors, &c." W. O. CALLENDER. Dated October 11. 4d. Consists in the use of bitumen, combined with other hydro-carbons or their equivalents in proportions varying from about twenty to sixty per cent. of the hydro-carbon relatively to the bitumen employed. The combination is effected at various degrees of temperature, according to the nature of the materials employed. A compound material is thereby produced which is available for covering and insulating wire or other conductors used for telegraphic, electric, or other similar purposes. The compound material so produced can either be vulcanised in the usual way, or used without being vulcanised.

5309. "Preparation of materials for electric insulation." J. A. FLEMING. Dated December 5. 4d. According to this invention there is taken wood or bran or other fibrous material in a finely divided condition, and having thoroughly desiccated the same, saturated it in or impregnated it with melted paraffine or mineral wax, or mixtures of paraffine or mineral wax and resin, or with other allied substance, either under pressure or not. The material thus treated is then moulded under pressure, so as to produce articles of a shape adapted to the purposes for which they are to be applied.

CITY NOTES.

OLD BROAD STREET.

SUBMARINE CABLES TRUST.

THE eleventh ordinary annual meeting of certificate holders took place at the offices, 66, Old Broad Street, on Tuesday, Mr. John Pender, M.P., presiding.

The Secretary having read the notice convening the meeting and the minutes of the previous meeting, which were approved and signed by the chairman, the report (see ELECTRICAL REVIEW, last issue) was taken as read.

The Chairman said: Before asking you to adopt the resolution that the report be received and adopted, it may be interesting to you to hear a few remarks upon the report. The revenue of the trusts for the financial year ending April 15th, was £23,535 11s. 3d., and the expenses amounted to £1,316 0s. 8d., and after paying the coupons at the usual rate of 6 per cent. we carried forward a balance of £1,837 10s. 7d. Our income has been more or less affected by the lower rate of the Anglo-American Company; but on the other hand, our other investments have been benefited and the Eastern extension has been improved very considerably since we held them first. The change of rate which has been current in the Anglo-American Company is, I think, very likely to be changed shortly. It has been very clearly proved that the 1s. tariff has not been a success, and whilst those representing those companies have been anxious to give it a very fair trial, I am strongly of opinion that anything under 2s. is not a tariff that is likely to pay the shareholders. Probably in the course of two or three years it may improve, as telegraphy is a very progressive system, but in the meantime such a tariff would mean a very heavy loss to the shareholders, and I believe we shall see it remedied by-and-bye. In the meantime it is satisfactory to know that the value of our coupons has considerably improved of late, and that the prospect of increased revenue upon the stocks we hold is likely still further to improve the value of our property. It will be observed in the balance-sheet that about one-fifth of the original capital has been already cancelled by the purchasers of the certificates. Of course when we have means to purchase we are always glad to do so. At the same time, as the value of the property is increasing, it makes it still more difficult to purchase upon terms which might be considered satisfactory. At the last annual meeting we had to express our regret at the serious illness of one of our auditors. Unfortunately, since that time Mr. Newmarch has been taken from us, and I believe to-day the shareholders will have to elect a gentleman to fill the place which Mr. Newmarch so ably filled for some years in connection with this company. As you are aware, one of our auditors who has acted always with Mr. Newmarch is Mr. Griffiths. I believe that during the time he has been associated with us he has commanded the confidence of the shareholders. He also comes up for election to-day. With these remarks I beg to propose that the report and accounts now submitted to the certificate holders be received and adopted.

Sir Daniel Gooch, Bart., M.P., seconded the motion.

Mr. Aston, Q.C., asked whether the Board would be able to pay the next dividend in full.

The Chairman: I don't like to pledge myself to anything, such is the uncertainty of human affairs; and whilst we are very hopeful, a great deal will depend upon whether the 2s. tariff is established or not. If that is established, there is no doubt we shall continue to pay the dividend.

Mr. Aston asked whether it would be continued to be paid to the end of the year.

The Chairman: I am not going to look forward. I think it is a dangerous thing to prophesy. You have the dividend to-day, and I sincerely hope you will get it at the next meeting. All that I can say is, that if my desires are realised, we shall have the 2s. tariff before long; and if we get it we shall be in a much better position than we are likely to be if the 1s. tariff is maintained.

The report was then unanimously adopted.

The Chairman: The next point is the election of auditors. That is a question essentially and completely in the hands of the certificate holders, and we consider they should exercise it on this as on every occasion.

Mr. Aston moved and Mr. K. Anderson seconded the election of Mr. J. G. Griffiths, and

Mr. Batten proposed and Mr. Keelinside seconded Mr. Aston, and

Mr. Donaldson proposed and Mr. Wells seconded Mr. John Lane as auditor of the accounts for the ensuing year.

In the result Mr. Griffiths and Mr. Lane were elected.

Mr. Aston moved and Mr. Batten seconded a vote of thanks to the chairman and directors, which was carried unanimously.

The Chairman: I am particularly obliged to Mr. Aston for proposing a vote of thanks to us. I am quite sure that we are anxious to do everything in our power to promote this trust, and we are equally anxious that an election of this kind should be entirely in the hands of the electors. I don't know Mr. Lane. I have never spoken to the gentleman, and I therefore may say that there has been no influence of any kind brought to bear to-day. I have a personal liking to Mr. Griffiths, who has been associated with the company for ten or twelve years, and therefore must express my pleasure that a gentleman so long associated with it has the confidence of the directors and also of the general body of the certificate-holders.

THE WEST INDIA AND PANAMA TELEGRAPH COMPANY, LIMITED.

THE directors' report for the six months ended 31st December, 1881, shows the amount to credit of revenue is £34,041 16s. 7d., and the expenses have been £25,086 13s. 8d., leaving a balance of £8,955 2s. 11d., which, with the balance of £8,708 8s. 2d. brought from last account, makes an available total of £17,663 11s. 1d., with which it is proposed to deal as follows:—Payment of 6s. per share on account of arrears of dividend on the first preference shares, £10,368 18s.; reserve account, £5,000; balance to current half-year's account, £2,294 13s. 1d.; total, £17,663 11s. 1d. The traffic receipts for the half-year ended 31st December, 1881, show an increase of £9,047 15s. 9d., as compared with those of the corresponding period of last year, during which the cables were frequently interrupted. At present every station is in telegraphic communication, and the company's ships are employed, the one in sounding operations, preparatory to making the deviations referred to in the last report, and the other in repairing one of the duplicated sections. It has been arranged that the conference of delegates from the British Colonies, on the subject of telegraphic communications, alluded to in the last report, shall meet at Barbadoes at the end of this month. Mr. Kingsford, who represented the company in the West Indies during the negotiations which resulted in the increase of tariffs in 1877, has proceeded to attend the conference, and to express the views of the company. He is accompanied by the secretary, who will assist him during the conference. The reply of the French Government to the company's application for a subsidy is deferred until the British Colonies have indicated by their action at the conference the measure of their appreciation of the benefits conferred by the company's system. Since the last report £15,000 additional debentures have been issued, making up the total of £50,000 authorised by the articles of association. It will be observed from the accounts that the value of cable used in deviating the route of the St. Kitt's end of the St. Thomas—St. Kitt's Section—has been charged to reserve account. At the meeting held on Wednesday, the 10th inst., under the presidency of C. W. Earle, Esq., the acting-secretary (Mr. J. L. Quick) having read the notice convening the meeting and the minutes of the last general meeting, the Chairman said: I presume, as usual, you will take the report and accounts as read? While we are meeting in discussion of our affairs here to-day there is another meeting going on on the other side of the world which may have a very marked effect upon our prosperity. I need hardly allude to the conference which we announce in this report as about to be held. That conference assembled at Barbadoes on the 1st of this month. It is attended by delegates of all the British colonies interested in telegraphic communication, with the exception of Jamaica, and that meeting is the outcome of Mr. Grovenor's visit some fifteen months ago, and the representations made by the board through him for the revision of the subsidies. We have secured the services of Mr. Kingsford, who conducted some negotiations for us in the West Indies successfully six years ago, to represent us; and it will be his duty to show to the colonies that the conditions and the terms accepted in the original contracts are not such that make it possible for us to attain to that fair position of commercial prosperity which is not only the essential condition of our establishment, but the very reason for our existence, and without which it is impossible for us to keep up constant and effectual communication with the colonies. I think the fewer remarks I make upon the subject being deliberated upon in the West Indies the better. I trust reasonable and liberal views will be taken in regard to the contracts. With regard to the action of France, they were in the first instance in favour of submitting to their Chamber a proposal to give us some assistance from the Home Government, but they not unnaturally deferred their action until they had seen what the British colonies would do. With considerable reason they said "the British colonies and England are very much more interested in the West Indies than we are, and we will wait and see what this large interest will do in the preservation of its own telegraphic communication before we step in." With regard to the question of our accounts, I have also very little to say upon the accounts. It is satisfactory to us to see there is an improvement over the corresponding period of last year of £18,000; our expenditure came to £9,000 less than in the previous period, and we received £9,000 more, making a difference of £18,000 improvement. Our cables have been very fairly at work all this half-year. We have had only one serious interruption—the Demerara cable. That cable differs in the circumstances in which it is laid down from all the other cables that belong to our system. Its bed is in deep alluvial soil, which is washed down by the waters of the great Orinoco and Essequebo rivers on the north-west coast of South America. All the other cables differ from the rocky nature of their beds. This cable lies in this deep mud, and it is difficult to repair on account of the depth it sinks into the soft soil on which it lies. That is a difficulty we find in that cable in particular, that it creates considerable delay in repair. I do not think I have any more remarks to make upon our report; but I shall be glad to answer any questions that may be put to me. I shall now move that the directors' report and the accounts to the 31st December last, as submitted, be, and the same are hereby, received and adopted; and, as recommended by the board, 6s. per share on account of arrears of dividend on the first preference shares be declared.

Mr. W. Ford: I beg to second that.

The next business was the election of a chairman, and Mr. Earle vacated the chair.

Sir James Anderson, upon assuming it, said: I have much pleasure in proposing the re-election of Mr. Earle; a more assiduous chairman, I think, could not be found in all London. He leaves no stone unturned to effect the interests of the company committed to his care. In re-electing him, you are not so much paying him a compliment as doing yourselves a good turn.

Mr. Andrews: I have very much pleasure in seconding the motion, and I can speak from some knowledge of the efficiency of our chairman.

Mr. W. Griffith said: I have much pleasure in supporting the motion. I think the prosperity of the company depends very much upon the efficiency of its officers.

The Chairman (having assumed the chair again) said: I thank you for the remarks concerning me that I have listened to on both

sides of the table. There is one point I should like to refer to—one correction in regard to what Mr. Griffith has said. He said that I have been connected with the company from its commencement.

Mr. Griffith: From its resuscitation.

The Chairman: Yes, that is so. I have now to propose that William Ford, Esq., be re-elected as director. I don't know that I need say much about Mr. Ford, or we may perhaps be termed a mutual admiration society (laughter).

Mr. R. Kendle: I have much pleasure in seconding that.

The Chairman: Another gentleman was about to second it.

Mr. Ford, in returning thanks, said: I am sure I am obliged to you for your renewal of confidence in me, and I think I should do well by preserving that discreet silence observed on the other side of the table, having regard to the conference now being held. It was my intention to address you at some length on the past history and my views with regard to the condition of this company.

The Chairman next proposed:—"Resolved that John George Griffiths be, and is hereby elected, auditor for the company for the current year, at a remuneration of forty guineas, and be authorised to spend sixty guineas on accountants' charges."

Mr. John Newton seconded, without further remark.

The Chairman: Before we break up I may, perhaps, make one remark upon one thing that fell from Mr. Griffith. We have been putting pressure upon the Home Government. There is, however, great difficulty on the part of the Home Government in putting pressure upon the colonies in pecuniary matters. If we do it too much it will defeat the object in view. We have been often enough to the Colonial Office, and put every conceivable argument before them. They are bound, by the constitutional nature almost of their relations to the colonies, not to interfere in any pressing way with any matters of a financial nature.

Mr. Griffith: I merely referred to private representation of the kind you suggest. Of course, it would be unconstitutional to press anything upon the colonies.

A Shareholder: I must express my regret that Mr. Ford has come to the conclusion to preserve silence on this occasion. I think the information given has been of the most meagre description. I have travelled several miles to hear something with regard to the present condition and future prospects of the company, and I am sure if Mr. Ford would indulge us with a few observations that they would not clash with or be prejudicial to the conference being held.

Mr. Ford: If the shareholder will oblige me with an interview in the offices, or in the next room, I think I shall be able to show him, and I think he will agree with me, that it would be indiscreet of me to enter upon an explanation of the condition of the company now.

The proceedings then terminated.

GREAT NORTHERN TELEGRAPH COMPANY.—This Company announced, under date May 3rd, that a station has been opened at Nankin. From the 1st May the uniform charge to the following Stations—Soochow, Chinkiang, Nankin, Chinkiangpoo, Chining, Lingching, Tientsin, Taku, has been raised to 9s. 7d. per word. There is a daily mail between Tientsin and Peking, leaving Tientsin at 3 p.m. and Peking at 4 p.m. Time of transmission 24 hours. Postage 10d. per message. The rate for Shanghai, Amoy, and Hong Kong, remains as before, 8s. 4d. per word.

THE WESTERN AND BRAZILIAN TELEGRAPH COMPANY, LIMITED.—This company notifies that, with the repair of the northern section of its cables in Brazil, telegraphic communication is now re-established with Ceara, Maranham and Para.

THE Montreal Telegraph Company Amalgamation Bill was read on May 4th in the Senate a third time and passed.

THE TELEPHONE CASE.

(*Continued from page* 332.)

MR. PEARSON, in opening the case for the defendants, said that in cases where two instruments very closely resembled each other it was difficult to draw a distinction, and the *a priori* conclusion is that one instrument was copied from the other; but in the present instance it was, if anything, a case of independent invention. Mr. Hunnings had experimented in ignorance of what had already been done; he had seen Bell's receiver, and had come to the conclusion that a proper transmitter was required to make it a commercial instrument. After various experiments and failures, he arrived at the present invention in total ignorance that Edison had also been experimenting. These experiments of Mr. Hunnings were made between November, 1877, and May, 1878. An iron case was used in the instrument, which was no tympanum in the sense that Edison used that word. Mr. Pearson here referred to the method of granting patents. The provisional specification was simply to describe the nature of the invention, and in Edison's provisional specification, he contended, the final form of his transmitter was not described—a make-and-break arrangement only was referred to. The "closed circuit" was not mentioned. It did not occur in the specification anywhere. It was very necessary that Edison should be tied to his complete specification, as it was not fair that a provisional specification should be used as a sort of drag-net to include everything, so as to anticipate and stop future inventions.

When Edison drew up his final specification, he admitted that he could not transmit speech by make-and-break, and he therefore substituted a closed circuit arrangement. He contended that the fact of the words "opening and closing circuit" being used in the provisional specification precluded the substitution of anything in the place of make-and-break. There was not in the specification a single detail that did not apply to make-and-break instruments. It was so vague as to be almost unintelligible. He considered that, as regards the motograph described, there was an excess in the final over the provisional specification. The idea of a tension regulator did not occur in the provisional specification. The use of the word semi-conductor was very vague. Edison has claimed really a particular combination of substances; his apparatus consisted of a tympanum, and a piece of cork attached to it, pressing down upon an electrode, which covered a case containing Mr. Edison's choice, whether it was elastic fibre or other elastic semi-conductor, and an adjusting screw, the latter being absolutely necessary to make the apparatus work properly. To call platinum foil a tympanum in the sense that Edison used it was, he contended, a misuse of language; a tympanum in the Hunnings apparatus would hinder its action. Mr. Justice Fry said that the vibrators of the platinum foil must cause pressure on the coke particles, but Mr. Pearson said that it would not do so in the sense that Edison meant. The Reiss transmitter, he contended, was practically Edison's transmitter, though its range of action was very limited, from the fact of the platinum points conducting too well. Both Gray and Bell's transmitters—the former using a conductor dipping in a liquid, and the latter plumbago dipping into mercury—were, he thought, tension regulators, and therefore anticipations of Edison's invention. Mr. Pearson next considered the Bell receiver. If Reiss's electro-magnet was taken and placed in a tube, and the plate in front allowed to touch the sides of the tube, then we had Bell's receiver. Mr. Justice Fry thought that by doing as Mr. Pearson had said the principle would be altered. Mr. Pearson did not agree, as the principle of a plate under inductive action existed in both cases. Referring to the original Bell instrument exhibited by Sir William Thomson at Glasgow, he referred to the question whether the plate on this instrument was intended to have been fixed at an angle, being held at one point, or whether it was intended to touch all round the edge. Sir William Thomson thought the former was the case, but he would call Mr. Watson, who had superintended the making of the instrument, to prove that the plate was intended to touch all round: the single screw was merely to keep the plate in position during its journey to this country.

A copy of the *Telegraphic Journal* for October 1st, 1876, was here put in for the purpose of calling attention to a description of the instrument in Sir William Thomson's inaugural address before the British Association, in which he spoke of a membrane stretched vertically across a tube, and touching at every point. No workman working from that description would bend the plate at an angle of 45°.

Mr. Pearson concluded his address by referring again to what he could not help thinking Mr. Edison's intentional vagueness in his provisional specification, and to the fact that he had no thought of carbon points originally, which he made so much of in his final specification. He used "platinum contact" and "points," when in the final specification the word "carbon" was substituted.

Mr. HERBERT JOHN ALLISON *sworn*.

Examined by Mr. GOODEVE.

Mr. Allison was examined chiefly to prove that the United States official *Gazette of Patents*, dated March 7th, 1876, which contained a description of Bell's invention, was on public view at the Patent Office on the 3rd July, 1876.

Mr. HENRY HUNNINGS *sworn*.

Examined by Mr. HEMMING.

Mr. Hunnings commenced his researches soon after September, 1877. The experiments which led up to his present invention were as follows:—To make the Bell instrument a commercial success he considered that a transmitter was required, and the first instrument made consisted of a mouthpiece, an iron plate, and a piece of platinum slightly dented; an adjustable screw fitted in the dent, so that the undulations affected the point of contact between the indented platinum and the head of the screw. This experiment failed to give good results, and the inventor next took a box, 2 feet long, with no lid, and a piece of paper glued over it all along; electrodes were placed at each end of the box, and a line of cinders between the two. This apparatus gave good results when spoken to. Mr. Hunnings next tried engine coke crushed up and covered in between two discs of paper fixed on either side of a wooden ring, a piece of tinfoil being pasted on either disc to make contact with the coke. This apparatus worked well, and the inventor by further improving arrived at the present form of instrument.

Cross-examined by Mr. ASTON.

Mr. Hunnings stated that he had not considered what was the reason why the instrument worked, and that the description given in his patent was entirely that suggested by the patent agent. The material he used in his transmitter, viz., powdered coke, he had never looked upon as being simply one form of carbon. He had tried lampblack after hearing of Edison's experiments, and had not found it to answer. All the experiments that had led up to the present form of transmitter had been made in total ignorance of any experiments having been made by other workers.

Mr. THOMAS AUGUSTUS WATSON *sworn*.

Examined by Mr. HEMMING.

Mr. Watson, between the years 1875 and 1877, was associated with Professor Bell in all his telephone experiments. The question which

his examination was more particularly required to bring out was the exact nature of the instrument seen at Philadelphia by Sir William Thomson. One of the receiving instruments exhibited there consisted of a circular iron box, closed at one end and open at the other, having inside it a core of soft iron surrounded by a coil of insulated wire. Over the open end of the box was a flat disc of thin iron mounted on a base, and the core had an adjusting screw by which the distance between the end of it and the diaphragm could be regulated. The witness stated that the iron disc in the instrument was *laid flat* on the open end of the box, not being screwed, and that it *touched all round*, though it did not touch the central iron core.

Cross-examined by Mr. WEBSTER.

Mr. Watson, in reply to Mr. Webster, stated that he presumed that a certain big piece fixed to the diaphragm (which had a hole through it and a corresponding hole on the iron edge of the iron tube, into which a screw was inserted) was fixed by Professor Bell's order.

Professor SILVANUS PHILLIPS THOMPSON *affirmed*.

Examined by Mr. PEARSON.

The witness considered the essential principle of Bell's invention to be the principle of transmitting electrical currents in a closed circuit, those currents being excited in the transmitter by the vibrations of an iron plate or other plate capable of inducing electric action by its vibration; those currents being induced on coils of wire surrounding the poles of an electro-magnet. As regards the receiver, Bell was the first person who put a permanent magnet into a receiving instrument capable of receiving a telephonic current. The particular way of producing magnetic disturbances by the movement of an iron plate, or something capable of an inductive action in the presence of a magnet, was Bell's discovery. The use of a membrane with a piece of iron on it was disclaimed. The witness had seen the apparatus at Glasgow exhibited by Sir William Thomson. According to the descriptions given in the papers the iron plate should be fixed at one point of its edge only, the plate being slightly tilted up. To make the instrument work well a thin plate was necessary. On being examined on the question of Edison's transmitter, Professor Thompson said he was not aware that any one had made experiments to find out what was the best substance to use for the tympan in the transmitter; mica would act least like a tympan, simply because it is a laminated substance. Edison, in defining a tympan, speaks of a "tympan or other instrument instead of a drum," by which the witness considered Edison meant the head of the drum and not the drum as a whole, with two ends and cylindrical sides. The scientific definition of a tympan diaphragm is "a diaphragm fixed at its circumference, and free to vibrate all round as the head of a drum does." This definition corresponds with Edison's specification with one trifling exception, viz., that Edison uses nothing but a central attachment. This latter does not, however, change the nature of the tympanum, which still remains a tympanum. Clerac's tube had been unquestionably used in telegraphy, as it is described in telegraphic books. The combination of a tympan with a tension regulator was not new, as it was employed in Reiss's apparatus. Plumbago contacts, which were spoken of in Edison's specification, had been employed in relays prior to 1877. The essential principle of the microphone is that there shall be nothing, no mechanical contrivances whatever, to prevent the air-waves—the sound-waves that is to say—from acting directly upon the material which varies the resistance of the current—that material being in loose contact between those parts, so that the air-waves can act directly upon it; in other words, it is loose contact in direct action. The witness did not consider this to be the case in the Edison transmitter, as he always described a substance which was cushioned up, and not free. There was a vital distinction between the two. There was a distinct difference between the Hunnings and the Edison transmitter. In the Edison there is a diaphragm tympan and a cork and a regulating screw. In the Hunnings there is no tympan, or cork, or regulating screw.

Mr. PEARSON: Those are the differences in the construction. Now, in the principle of working, what is the difference in the principle of working in the two instruments?—It is this, that the vibrations of the air are collected by this mechanism, and impressed upon the mass underneath, the mass already under elastic compression, and its resistance is thereby caused to vary. In the other case, we have a thin, comparatively loose piece of platinum foil—the electrode, in fact, which, when you talk to it, shakes, and shakes the carbon underneath it, producing a larger or smaller number of contacts, and in that way the resistance to the passage of the carbon is varied, so the action in one case is physically indirect; in the other case, as direct as the arrangements of the instrument which are admitted.

Mr. JUSTICE FRY: In the second case would the electrode vibrate as a tympan?—Not as a true tympan, because it cannot ripple in circuits as the true tympan can.

How will it ripple?—I question very much whether it would ripple.

You speak about it pressing on the carbon underneath?—If it is in proper condition of looseness it will simply be pushed up and pulled down, as a whole, by the air-waves that impinge on it as the little electrode in the Edison is pushed up and down by the pressure.

That would be the resultant of waves?—Of waves themselves in any case. All the air does in a sound wave, a plane wave, is that the particles of air in that wave move backwards and forwards, they oscillate, and then oscillate this piece of foil and make more or fewer contacts against the loose coke underneath. In either case you talk to a tympan; that is to say, a drumhead which is set into ripples, and those ripples have nodal lines in circles all round, and the resultant of those, with more or less imperfection, as represented by the movement up and down at the central point. I draw a complete distinction between the motion you have in the tympan itself and in the platinum electrode at the bottom.

Supposing the same sound is uttered to an Edison transmitter and to a Hunnings transmitter, will the up-and-down motion result in the cork of the one and in the platinum foil of the other?—Very nearly, but in the case of the Hunnings' that would be more true to the real vibrations of the sound than in the case of the Edison.

There would be a certain amount of disturbance in the transmission?—Yes, the mechanism necessarily implies that you lose something.

But subject to that loss, the up-and-down motion to which you speak, the same utterance of sound is the same with the cork in one and the platinum in the other?—The two electrodes move up and down absolutely identically, subject to the necessary imperfections on account of the mechanism of the cork.

I suppose those principles which lead to those similar results were familiar to persons familiar with acoustics?—I am not quite clear how much we knew at that date. It was known that a tympan when it vibrated rippled in circles; it was known that the central point would represent more or less accurately the resultant of the motions imparted to the tympan; and it was also known, what Sir William Thomson explained when he was in this place, that a limp, a perfectly limp sheet, acted upon by the waves of the air, would follow every wave of the air without being thrown into ripples upon its surface. But I think I am justified in saying that in the case of the Hunnings transmitter we realise the direct action as nearly as we can, whereas in the Edison transmitter we have this mechanism which first takes these waves which move up and down, and causes them to set this tympan rippling, and then takes the resultant, or, as far as can be, the resultant of those ripples as a central point, and pumps that into the electrode.

In the Hunnings you get the up-and-down motion from the voice direct on to the particles?—Yes.

In the other case you translate it into nodal waves, re-translate the nodal waves into an up-and-down motion?—Your lordship has expressed it precisely.

Mr. PEARSON: May I take it that you do not consider platinum foil, the electrode in Hunnings' instrument, the same thing as the tympan in Edison's instrument?—No, because it acts in entirely a different way; it corresponds to the platinum electrode in Edison's. In the Hunnings apparatus the inventor tries to get rid of compression as much as he can, in the Edison there is a mechanism to produce a compression.

Mr. PEARSON: Am I right in saying from what you said, in all cases of contact there must be pressure?—You cannot help it, I am afraid.

Do you make a distinction between the pressure you cannot get rid of, and the compression which is brought in purposely by mechanism?—I draw a very broad distinction between them—one is purposed, the other is what one cannot get rid of.

If it was possible to get contact in the coke without pressure, would the coke work just as well as it does now?—I am inclined to think it would, because I have made experiments in which the pressure was not applied so as to push the electrodes on to the coke, in which the pressure of the moving sound-waves literally rattled a heap of coke. It stands self-evident to my mind, if the waves of air of the voice can set up vibration in a disc of iron or mica fixed rigidly all round that they can, of course, rattle a heap of cinders in which they are loose, and open to the air.

Mr. JUSTICE FRY: Your view is that the whole activity of Hunnings' depends upon the free action of the air in what I may call the cell produced by the foil—I mean the case—the brass ring on one side, the brass bottom and the tinfoil at the top, and the box or cell. In that there are loose particles of coke?—Yes.

In that, vibrations are produced by the up and down movements of the foil?—Yes.

The free action of those vibrations produced by the up-and-down motion of the foil upon the comparatively free particles of coke in the box is, in your view, the operative principle; is that so?—No, not quite that. I do not think it is the air inside the box that moves the particles inside the box. We have the actual foil itself moving up and down, and rattling the heap of stones, and making more or fewer contacts. We cannot help that.

That is compression?—So it would be if this were an upper layer of coke.

I do not at present see your distinction between compression in one case and pressure in another.—We cannot get rid of the fact.

Never mind, you have it.—We have it.

If the pressure is not the operative principle in that case, what is?—The inventor tried to get rid of pressure as much as possible.

I do not want to press you, but if it is convenient to you, would you tell me what you consider to be the operative principle in that?—That the air itself shakes the very things through which the electricity is passing.

Shakes the coke?—The platinum touches the coke. The air shakes the platinum through which the current runs to touch a piece of coke, the air outside does not shake directly that piece of platinum.

What I am on is the operation in the box—not outside. See whether I follow you. I have got down to this, that the result on the two platinum foils is nearly equivalent.—Very nearly, as near as can be, saving the difference of material.

Leaving everything before you reach that platinum, what is the difference after you reach the platinum, what is the difference inside the cell—in the one case it is compressed, what is it in the other?—There is more or less contact, there is movement of the particles.

What causes that?—A movement up and down.

That is compression of the foil?—Not the compression.

The pressure?—A slight pressure—you cannot help it.

I know that, I only want to follow you. You say there is a distinction?—Yes, because in one case you are employing mechanism to get the force of the air transmitted to the platinum——

If I follow you it is this, you say there is a difference in the intent in the mind of the inventor?—And not only in the intent of his mind but in the actual invention which he puts before us to carry out that intent.

In each case the action on the particles in the box is due to the pressure of the foil?—Is due to the movement of the foil.

Which creates pressure, does it not?—Which is caused by pressure.

Is it produced by pressure?—The motion is produced by pressure.

Does it also in its turn produce pressure?—It cannot help it.

Mr. PEARSON: I can put what your lordship is asking in a question.

Mr. JUSTICE FRY: I am only anxious to get at what is in Mr. Thompson's mind as to the reason of the activity after you pass that point.

Mr. PEARSON: I will put another question which will assist the Professor in explaining what he means, I think.

I suppose that it is not necessary that the platinum foil should be there to act as an electrode in Hunnings' instrument; you might arrange it differently?—Certainly.

If the top were left off, the platinum not being there, the electrode would work?—It would work as well in transmitting.

Mr. JUSTICE FRY: There the voice would come directly upon the particles?—My lord, may I just direct your attention to this point in explanation of that? The particles of platinum there are themselves concerned in transmitting the electricity to the coke, that is, when the voice reaches the platinum particles it is reaching the particles concerned in transmitting electricity. In the other instrument, the Edison receiver, the waves do not reach any part concerned in transmitting electricity.

What I put was this, supposing you took away the foil in Hunnings and spoke to it without the foil, then the motion of the particles would be due to the direct action of the waves produced by the voice?—Yes.

Without the intervention either of the tympan or of the cork, or of a piece of foil?—Certainly.

That would be just as operative?—Yes, provided you bring an electrode to one side, and it is even more perfect as a transmitter of speech.

Mr. PEARSON: Following my last question, the arrangement of the platinum foil, where it is found in Hunnings' instrument, does not assist the action?—No, it impedes it.

The witness stated that a heap of cinders placed on two electrodes, the latter resting on putty, would answer as a transmitter; the putty could not in this case be possibly called a diaphragm. Lampblack would not work (except very feebly) in a Hunnings transmitter. Metal filings on the latter would work, but not well. The Cox-Walker receiver and the receiver exhibited by Sir William Thomson at Glasgow were practically the same, if the plate in the latter instrument was held down so that it touched all round its edge. The phonograph was afterwards brought in, in evidence, to prove that the word "recording" given in the specification of Edison does not mean "production." With reference to Reiss's apparatus Prof. Thompson considered that within a certain range it could work without a break; the transmitter possessed all the elements of a tension regulator. Compared with Bell's receiver, as exhibited by Sir W. Thomson at Glasgow, the Reiss receiver had a great deal in common, that is, electrically, though structurally it was different.

Now, looking at that Reiss receiver, Professor Thompson, and looking at Bell's receiver, will you tell me what difference in principle there is between the two?—Electrically, there is a great amount of correspondence, although the exterior form is very different. You have an electro-magnet in one case, consisting of a horseshoe with two poles; in the other it is inclosed in an iron tube. Opposite the pole of each there is iron—in one case in the form of a small bar, in the other case of a flexible iron sheet. In either case the varying magnetism of the electro-magnet can produce motion in the armature.

Then, substantially, what difference in principle is there between them?—The main difference in principle is, if there is any, that in one case the iron will oscillate merely, communicating vibrations to the other parts of the apparatus—the sound-board for instance; in the other case the iron will actually vibrate—this piece of iron is practically unbendable.

I asked you to compare it, I think, with Bell's?—This is Bell's. I compared it with the Bell receiver, the ordinary Bell telephone. In one case, the Reiss, we have the electro-magnet with its iron armature held back by a spring, in the other case we have a permanent magnet with a coil upon its poles, and opposite that we have a thin disc of iron. There is no essential difference in the main point, namely, that the varying currents of electricity in each case alter the strength of the magnetic field, and therefore attract a piece of iron more or less. There is an essential difference, that one has a permanent magnet the other only an electro-magnet. In the one case we have a tympan of iron which can vibrate, in the other case we have a lump of iron which can oscillate only.

Will you compare it with the Cox-Walker? (Exhibit F. J. B. 6 was handed to the witness.)—Comparing the Reiss receiver with the Cox-Walker, I have in both an electro-magnet, in both that electro-magnet is of the horseshoe type, in each there is iron in front of that electro-magnet, and in each the varying strength of current in the line will alter the strength of the magnet, and will make it attract the iron more or less, but in one case, the Reiss, a piece of iron will oscillate to and fro only, with a spring to pull it back; in the other case the iron tympan will vibrate, being elastic.

Then the difference really consists in the shape of the armature in front of the magnet?—I see no other essential difference, saving only this, which I believe is not in dispute at this trial—one has a mouthpiece and the other has not.

On further examination, with reference to Reiss's transmitter, Prof. Thompson stated that the instrument was strictly a "tension regulator"; the resistance between a platinum point and a flat electrode can vary continuously from perfect contact to affinity by the two being pressed more or less against each other.

The effect of the voice increases or diminishes the pressure at the point where the platinum rests upon the central pin, so to speak?—Certainly, unless you speak too loud; in that case it will hop up and down upon the platinum and make and break contact. So long as you do not talk too loudly to that instrument the whole result is that the platinum electrode underneath the point presses up with more or less pressure against the front that reposes against it.

I do not, at the present moment, understand how a point can be a regulator; because I should have thought the point was either in contact or not in contact?—It is so, that is to say—and all the evidence goes to show—that mere make and break cannot transmit articulate speech. Take Sir William Thomson's illustration, which was copper hemispheres or spheres. When they touch at infinitesimal point they offer at that point a very great resistance to the passage of the current—it cannot pass through a mere point—but you press them together and you increase the amount of surface in contact, for all metals are more or less elastic. Consequently the small increase of pressure between these two points of contact increases the area of contact; and, therefore, diminishes the resistance. We had it in Sir William Thomson's own language—and I cannot improve it—that the resistance between two perfect conductors at the point of contact may vary continuously from an enormous resistance down to the resistance of a small fraction of one ohm.

(To be continued.)

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations. May 10.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	4	18¾-19¼	18.18¼.18.18⅞. 19.18¾.19¼.19.18¼ ac.
		Do. Do.	10	42 - 44	41¼.3.4m. 42½.3.2.3½ ac.
150,000	1	Electric Light and Power Generator Co.	1	⅞- 1⅛	1m. 1 1/16. ac.
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	54¾ 54¾	54¾ m.
2,441,800*l.*	Stk.	Do. Preferred { Def'd. receiving no div. until }	100	85½ 86½	85¾*.⅞.¾ m 85⅞.6¼ ac.
2,441,800*l.*	Stk.	Do. Deferred { 6 p. c. has been paid to Pref. }	100	24½- 25	24¼m. 24¼ac.
130,000	10	Brazilian Submarine, Limited	10	11⅛- 11⅜	11¼. 11⅜
16,000	10	Cuba, Limited	10	8½- 9	9 m. 9 ac.
6,000	10	Do. 10 per cent. Preference	10	15½- 16½	
13,000	10	Direct Spanish, Limited	9	5½- 6¼	
6,000	10	Do. 10 per cent. Preference	10	14½ 15½	
65,000	20	Direct United States Cable, Limited, 1877	20	11½- 12	
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	101 -104	
380,000	10	Eastern, Limited	10	10 - 10¼	10¼. 3/16 m.
70,000	10	Do. 6 per cent. Preference	10	12¾- 13	
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1933	100	99 -102	100 m.
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101 -104	
200,000*l.*	100	Do. 5 do. do. Aug. 1890	100	102 -107	
199,750	10	Eastern Extension, Australasia & China, Limited	10	11¼- 11⅜	11¼ ac.
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	100	106 -110	
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	103 -106	
140,000	100	Do. do. registered, repayable 1900	100	103 -106	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	101 -104	
254,300*l.*	100	{ Eastern and South African Limited 5 per cent. } { Mort. Deb. Registered redeemable 1 Jan. 1900 }	100	103 -105	
345,700*l.*	100	Do. do. do. To Bearer	100	103 -106	
22,050	10	German Union Telegraph and Trust, Limited	10	9⅞- 10¼	
163,390	10	Globe Telegraph and Trust, Limited	10	6⅜- 6⅝	6 7/16m. 6½ac.
163,209	10	Do. 6 per cent. Preference	10	12½- 12⅝	12½m. 12⅝ac.
125,000	10	Great Northern	10	12¾- 13¼	13 m.
100,000*l.*	100	Do. 5 per cent. Debentures	100	102 -105	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	26 - 27	
100,000	100	Do. 6 per cent. Debentures, 1885	100	101 -105	
17,000	25	Indo-European, Limited	25	30 - 31	
38,148	10	London Platino-Brazilian, Limited	10	4¼- 4½	
12,000	10	Mediterranean Extension, Limited	10	2 - 2⅛	
8,200	10	Do. 8 per cent. Preference	10	8½- 9	
9,000	8	Reuter's, Limited	8	12⅞- 13½	12⅞ m.
280,000	Stk.	Submarine	100	260 -270	
58,225	1	Do. Scrip	1	2⅞- 2⅞	
4,200	Cert.	Submarine Cables Trust	100	103 -106	
37,350	12	Telegraph Construction and Maintenance	12	30 - 31	30 * m.
150,000	100	Do. 6 per cent. Bonds, 1884	100	102 -105	
186,750	5	Do. 2nd Bonus Trust Cert.	5	1⅛- 1⅜	1⅛ ac.
30,000	10	West Coast of America, Limited	10	5¼- 5¾	
150,000	100	Do. 8 per cent. Debentures	..	.. 8	
69,910	20	Western and Brazilian, Limited	20	7⅞- 8	7⅞m.
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	107 -112	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80, red. Feb., 1910	100	99 -102	
1,500	$1,000	Western Union of U. S. 7 p.c.1 Mort.(Building) Bds.	$1,000	121 -126	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	102 -105	
88,321	10	West India and Panama, Limited	10	1¾- 2	1 13/16 m.
34,563	10	Do. 6 per cent. 1st Preference	10	3½- 4	
4,669	10	Do. 6 do. 2nd do.	10	6¼- 7¼	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	1⅛- 1⅜	
200,000	1	Oriental Telephone Co.	¼	⅛- ¼	⅜ m.
100,000	5	United Telephone Co.	5	15 - 16	13 3/16. 3/16. ½. 15½ m. 14 ac.

* Exceptional amount at special price.

TRAFFIC RECEIPTS.

The Cuba Submarine Telegraph Company, Limited. The number of messages passing over the lines of this company during the month of April was 3,933, estimated to produce £3,800, against 3,058 messages, producing £3,193, in the corresponding month of last year. The traffic receipts for the month of February, estimated at £3,200, realised £3,271.

The Direct Spanish Telegraph Company. The earnings of this company for April were £1,824, against £1,337 in the corresponding period.

The Eastern Telegraph Company. The earnings of this company for the month of April amounted to £42,637, against £45,283.

The Eastern Extension, Australasia, and China Telegraph Company. The earnings of this company for the month of April amounted to £29,269, compared with £26,746 in the corresponding period of 1881.

The Great Northern Telegraph Company. The traffic receipts in April, 1882, were £17,640, from the 1st January to 30th April, 1882, £71,280, and for corresponding months of 1881, £71,156, and 1880, £66,316.

The West India and Panama Telegraph Company, Limited. The estimated traffic receipts of this company for the half month ended the 30th April are £3,219, as compared with £2,946 in the corresponding period of 1881.